Testimony of Erin Burns, Director of Policy, Carbon180
U.S House of Representatives Committee on Science, Space, and Technology
June 19, 2019
Hearing on Fossil Energy Research: Enabling our Clean Energy Future

Introduction

Thank you for the opportunity to testify about the Fossil Energy Research and Development Act today. I'm Erin Burns and I'm the Director of Policy at Carbon180, which is an NGO focused on carbon capture, removal, and use with the goal of building an economy that sequesters more carbon dioxide than it emits.

We choose to work on these issues for one primary reason: climate. We have a responsibility to take immediate and ambitious steps to avoid the worst impacts of climate change, and carbon removal — alongside renewables, energy efficiency, and other emissions reduction efforts — can play an integral role in eliminating global emissions. At the same time, we also have an opportunity to turn those carbon emissions into an asset, spurring American innovation and economic growth.

We are supportive of the Fossil Energy Research and Development Act, as well as the Industrial Decarbonization Technology Development Act. My testimony will focus primarily on the first bill, which we support for three major reasons.

Carbon Removal

First, this bill establishes the first-ever dedicated Carbon Removal Program at the Department of Energy.

The term 'carbon removal' refers to a broad set of technologies and practices that remove carbon dioxide from the ambient air all around us, and includes a technology called direct air capture. While direct air capture is a relatively new technology, there are nearly a dozen small-scale plants deployed today with plans recently announced to build a plant that would remove half a million tons of carbon dioxide a year. To bring this technology to scale in time to meet climate goals and to maintain American leadership on innovation, it's time for the federal government to significantly increase support for carbon removal. Luckily, we know how best to do that.

Towards the end of last year, the National Academies of Sciences released a report that detailed how the federal government can effectively move carbon removal forward. One of their most important recommendations was to implement an ambitious federal research, development, demonstration, and deployment program for direct air capture and other carbon removal

approaches. To date, the Department of Energy has spent around $11 million ever on direct air capture, far below the $10s and $100s of millions of dollars of annual funding recommended in the report.

This legislation would scale up those efforts and get us far closer to the levels the National Academies recommends. The Office of Fossil Energy has a long history of work on carbon capture technologies and that expertise is well-suited to tackling the challenges around technologies like direct air capture.

Natural Gas and Industrial Sources

The second reason we support the Fossil Energy Research and Development Act is because it expands the Carbon Capture Program to include natural gas and industrial applications.

With the rapid growth of natural gas in the U.S., it is essential that the Office of Fossil Energy expand its historical focus beyond carbon capture applications for coal power plants to include work on natural gas plants.

Carbon capture is also essential to reducing emissions in the industrial sector, which represent around ⅛ of total U.S. emissions. We need to begin decarbonizing the production of steel, cement, and other industrial processes today. Efficiency, certain renewables applications, and advanced nuclear can all play a role. However, carbon capture will continue to be an important part of decarbonizing this sector.

The provisions in this bill to incorporate work on carbon capture for natural gas and industrial plants reflect the reality of our changing electricity generation mix and are key to helping us meet climate goals.

We are also very supportive of the Industrial Decarbonization Technology Development Act. It is essential that the U.S. work on a broad set of technologies, including but not limited to carbon capture, to rapidly reduce and eliminate industrial emissions. The robust funding in this bill is an enormously important step towards that goal.

Carbontech

The third reason we support the Fossil Energy Research and Development Act Act is because it builds on the Office of Fossil Energy's great work on carbon utilization. Taking carbon dioxide from smokestacks or the ambient air and turning it into commercial products, such as plastics, fuels or building materials, is what we call carbontech, and it offers a promising near-term opportunity to begin commercializing the technologies needed for an economy where we remove more carbon than we emit.

There are dozens of these carbontech companies and start-ups in the U.S. today and the U.S. is home to more of these projects than any other country in the world. We have an opportunity to build a significant domestic carbontech industry. In fact, according to our analysis, there is a $1 trillion total available market for these products in the U.S. alone and a nearly $6 trillion total available market globally.

To date, the Office of Fossil Energy has spent only about $10 to $12 million annually on carbontech research and demonstration funding. They've done some great work. But they can do more and better work. This bill would nearly triple our current annual investment in these technologies and put the U.S. in a much stronger position to fully take advantage of this enormous economic opportunity.

Conclusion

Carbon capture and removal are key to addressing climate change and can help drive economic growth, and federal policy action today can help unlock both opportunities. As Congress considers climate policies, like this bill, we recommend looking to examples like the Carbon Capture Coalition and similar efforts where a broad set of participants, including environmental organizations, labor unions, start-ups, large companies, and others have helped drive policy development and advocacy. Engagement with labor unions, in particular, who have been foundational for carbon capture work historically, is key to unlocking the full economic potential of carbon capture, removal, and use.

Thank you again for the opportunity to be here today. Carbon180 strongly supports the Fossil Energy Research and Development Act and the Industrial Decarbonization Technology Development Act, and we are very grateful for the hard work of the Committee staff and others who have put these bills together, and I look forward to your questions. Thank you.

Additional Comments

Direct Air Capture

Towards the end of last year, the United Nations Intergovernmental Panel on Climate Changed released their "Special Report: Global Warming of 1.5 °C." In this report, scientists found that carbon removal will almost certainly be required in all pathways that keep us within 1.5 °C of warming.[1]

[1] https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf

Around the same time, the National Academies of Sciences released a report titled, "Negative Emissions Technologies and Reliable Sequestration: A Research Agenda," which detailed how the federal government can move carbon removal forward. One of the most important recommendations in their report was to implement an ambitious research, development, demonstration, and deployment (RDD&D) program for direct air capture (DAC) and other carbon removal approaches. The recommended program for DAC ranges between $60 and $240 million annually.[2] (We've compiled a list of the key takeaways from the report here.) To date, the Department of Energy (DOE) has cumulatively spent around $11 million ever on direct air capture. Getting to the level of funding in the NAS report will require a serious ramp up; however this increase in funding will need to be done on a timeline that allows the DOE to establish and scale up their first-ever dedicated Carbon Removal Program.[3] We believe the Fossil Energy Research and Development Act strikes this balance with funding in the roughly $60 to $70 million a year range.

We also appreciate and agree with the bill's recognition of the Office of Energy Efficiency and Renewable Energy's Bioenergy Technologies Office's (BETO) role in supporting the RDD&D of DAC. BETO has historically been involved in the DOE's work on DAC and some of the issues related to DAC deployment, including integration with renewable power, necessitate cross-program coordination.

Right now is an especially important time for the DOE to expand its work on DAC. After the passage of the updates to the 45Q tax credit in February 2018 to include DAC for the first time, we have seen increasing interest from the investment community in supporting these technologies.[4] In particular, Carbon Engineering, a leading DAC company, has had two major announcements in the past several months. The first was a $68 million investment from Occidental Petroleum and Chevron earlier this year.[5] The second was the recent announcement that Carbon Engineering is beginning engineering work on what will be the world's largest DAC plant at half a million tons.[6]

DOE has experience supporting first-of-a-kind projects and this support has been key in scaling up other climate and clean energy technologies. In fact, the NAS specifically states, "The U.S. Department of Energy's Office of Fossil Energy and National Energy Technology Laboratory (NETL) has the appropriate infrastructure to manage direct air capture, research, development, and demonstration projects through a typical grant process that distributes funds to projects at

[2] https://www.nap.edu/catalog/25259/negative-emissions-technologies-and-reliable-sequestration-a-research-agenda
[3] https://bipartisanpolicy.org/wp-content/uploads/2019/03/Carbon-Removal-Comparing-Historical-Investments-with-the-National-Academies-Recommendations.pdf
[4] https://medium.com/@carbon180/the-case-for-investing-in-direct-air-capture-just-got-clearer-e08be7f35a83
[5] https://carbonengineering.com/carbon-engineering-concludes-usd68-million-private-investment-round/
[6] https://carbonengineering.com/worlds-largest-direct-air-capture-and-sequestration-plant/

universities, nonprofit research organizations, start-up companies, and large companies."[7] DOE has significant experience with these types of efforts. The Petra Nova plant in Texas, the only commercial carbon capture power plant in the United States and one of only two globally, benefitted from a DOE grant.[8] Similarly, the Illinois Industrial Carbon Capture and Storage project has received both DOE and private sector funding and is the only large-scale bioenergy with carbon capture plant in the world.[9] This project is also notable because it incorporates geologic storage, which will be vital to the long-term success of carbon capture and removal. DOE is also well-positioned to continue work on BECCS given the success of the Biomass Research and Development Initiative[10] and ARPA-E's TERRA,[11] both of which aim to develop highly efficient and sustainable bioenergy feedstocks.

The NAS report goes on to suggest that "For development and demonstration testing of direct air capture components and systems, a centralized facility/national testbed akin to the NETL's National Carbon Capture Center...is recommended." We believe the bill's inclusion of a dedicated Direct Air Capture Test Center implements this particular recommendation and builds on the DOE's existing expertise.

Finally, continued policy support, including federal RDD&D, can help drive down technology and deployment costs of DAC. A recent report from the Rhodium Group, "Capturing Leadership: Policies for the U.S. to Advance Direct Air Capture," argued that with current DAC technology and no additional innovation, costs could end up at less than $50 per ton.[12] Innovation from public-private partnerships could further drive down these costs.

With federal policies like 45Q, increased interest from the investment community, and the NAS roadmap, now is the time for DOE to scale up their work on DAC. We believe the approach in the Fossil Energy Research and Development Act — establishing a dedicated and well-funded Carbon Removal Program — is the best path forward.

Other Carbon Removal Pathways

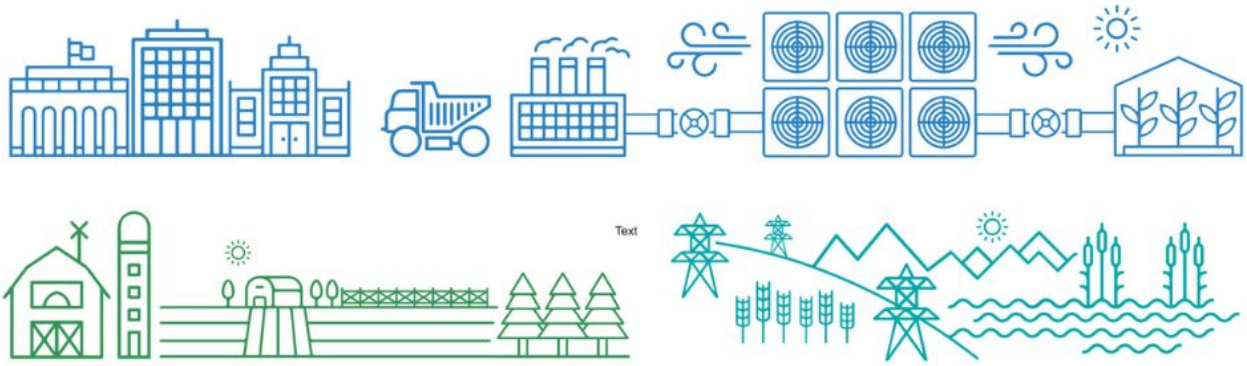
The term 'carbon removal' encompasses a broad set of engineered, biological, and hybrid pathways for removing carbon dioxide from ambient air. Below is a figure from the New Carbon

[7] https://www.nap.edu/catalog/25259/negative-emissions-technologies-and-reliable-sequestration-a-research-agenda, page 243
[8] https://www.nrg.com/case-studies/petra-nova.html
[9] https://www.energy.gov/fe/articles/doe-announces-major-milestone-reached-illinois-industrial-ccs-project
[10] https://nifa.usda.gov/funding-opportunity/biomass-research-and-development-initiative-brdi
[11] https://arpa-e.energy.gov/?q=arpa-e-programs/terra
[12] https://rhg.com/wp-content/uploads/2019/05/Rhodium_CapturingLeadership_May2019-1.pdf

Economy Consortium's report, "Building a New Carbon Economy: An Innovation Plan," which provides additional details on these pathways.[13]

FIGURE 1. *Solutions in a New Carbon Economy*

The knowledge foundation of the new carbon economy spans many disciplines and economic sectors.



ENGINEERED SOLUTIONS, which include technologies and systems that capture, convert, and store CO_2 from the air and oceans, such as direct capture of CO_2 from air and point sources, converting CO_2 into valuable products (e.g., concrete or fuels), and the accelerated mineralization of CO_2 for sequestration.

BIOLOGICAL SOLUTIONS, which include the use of working forests and farmland to store carbon, increase yields, and improve ecosystem functions. Biological solutions include ecosystem restoration, improved forestry practices, changes in agricultural practices, developing soil amendments that improve soil health, and cultivating and converting algae into valuable products such as fertilizer and animal feed.

HYBRID SOLUTIONS, in which biological and engineered pathways come together to create energy and/or products. Hybrid energy solutions can include bioenergy with carbon capture, biochar production, waste-to-energy systems, and carbon-cultivating aquaculture.

The Carbon Removal Program authorized in this bill extends beyond technological removal — DAC, bioenergy with carbon capture and storage (BECCS), and carbon mineralization — to include removal on natural and working lands. Recent research has demonstrated that the United States' natural and working lands can capture and store a significant portion of our emissions, while also increase the productivity of the agricultural and forestry sectors.[14] The inclusion of both natural and technological CDR is important as leading analysis has indicated both will be necessary to avoid catastrophic climate change impacts.[15] Additionally, natural carbon removal

13 https://static1.squarespace.com/static/5b9362d89d5abb8c51d474f8/t/5b98383aaa4a998909c4b606/1536702527136/ccr02.innovationplan.FNL.pdf

14 https://advances.sciencemag.org/content/4/11/eaat1869?utm_source=TrendMD&utm_medium=cpc&utm_campaign=TrendMD_1

15 https://iopscience.iop.org/article/10.1088/1748-9326/aabf9f/meta

solutions are comparatively more affordable, offer a suite of environmental co-benefits, and provide a valuable rural development opportunity.[16] We believe the bill appropriately prioritizes technological removal, as it fits well within the DOE's expertise and experience supporting the commercialization of carbon capture.

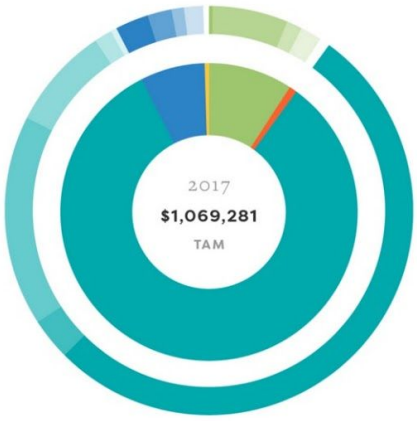
Carbontech

We use the term 'carbontech' to refer to an emerging sector where value is created from the conversion of industrial and atmospheric carbon to fuels, fertilizers, chemicals, plastics, materials, and other commercial products. Carbontech represents a $1 trillion total available market in the U.S. alone and a nearly $6 trillion market globally.[17] Below is a table that breaks out this market by sector.

[16] https://www.wri.org/publication/land-carbon-removal-usa
[17] https://carbon180.org/carbontech-labs-reports

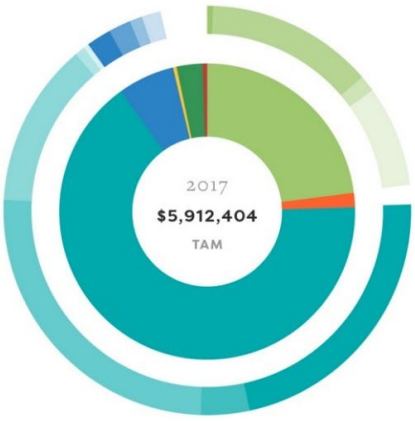
KEY CARBONTECH MARKET SEGMENTS AND FINDINGS

US



PRODUCT	$ IN MILLIONS
BUILDING MATERIALS	$101,130
Cements	$1,240
Concretes	$65,000
Asphalts	$12,190
Aggregates	$22,700
WOOD-BASED PANELS	$12,508
FUELS	$882,149
Gasoline	$543,400
Jet Fuel	$38,760
Diesel	$186,660
Natural Gas	$83,705
Ethanol	$23,550
Biodiesel	$6,074
PLASTICS	$71,694
High density polyethylene	$25,393
Linear Low density polyethylene	$20,502
Low density polyethylene	$11,522
Polypropylene	$14,276
CHEMICALS	$1,800
AGRICULTURE AND AQUACULTURE	N/A
CONSUMER GOODS	N/A
TOTAL	$1,069,281

GLOBAL



PRODUCT	$ IN MILLIONS
BUILDING MATERIALS	$1,368,100
Cements	$24,900
Concretes	$800,000
Asphalts	$77,200
Aggregates	$466,000
WOOD-BASED PANELS	$96,513
FUELS	$3,821,316
Gasoline	$1,261,000
Jet Fuel	$216,318
Diesel	$1,510,080
Natural Gas	$773,242
Ethanol	$36,720
Biodiesel	$23,956
PLASTICS	$412,448
High density polyethylene	$128,250
Linear Low density polyethylene	$103,546
Low density polyethylene	$58,311
Polypropylene	$122,342
CHEMICALS	$20,217
AGRICULTURE AND AQUACULTURE	$169,450
CONSUMER GOODS	$24,360
TOTAL	$5,912,404

Today, the U.S. has an advantage in carbontech, as we have more companies and projects in this field than any other single country.[18] There is also increasing interest from the investment community, ranging from start-up accelerators like Y Combinator and our own Carbontech Labs to larger groups like the Oil and Gas Climate Initiative (OGCI) and Bill Gates's Breakthrough Energy Ventures. Federal policy can catalyze this interest and unlock further investment to fully leverage the economic opportunity of carbontech.

[18] https://www.thirdway.org/graphic/carbon-capture-projects-map

Industrial Carbon Capture

Climate policy often focuses on what is needed to decarbonize the electricity sector. While this is undoubtedly important, particularly as we move to electrify transportation and other sectors, we need to also consider other major sources of emissions.[19] The industrial sector directly accounts for around 1/5 of total U.S. emissions; factoring in emissions from the electricity used by this sector, it accounts for around 29% of total U.S. emissions — making it the single largest emitting sector.[20]

Often, very high temperatures are required for industrial processes and while we need to be researching and developing direct zero-carbon methods to provide those temperatures, right now, that mostly means burning fossil fuels. We should be using carbon capture to prevent those emissions from entering the atmosphere. Even once we are able to replace fossil fuels with other options, there will still likely be a role for carbon capture. Producing cement creates a chemical reaction which results in carbon dioxide — it isn't just the burning of fossil fuels, but the actual production of this material we use every day that creates carbon dioxide. Right now, carbon capture is the only technology we have to keep those emissions from contributing to climate change.

While we expect carbon capture to be essential to decarbonizing industry, there are several other technologies and practices that can play a major role. The Industrial Decarbonization Technology Development Act recognizes this fact and authorizes an appropriately ambitious program to scale these solutions.

[19] https://www.globalccsinstitute.com/resources/publications-reports-research/industrial-ccs/

[20] https://www.thirdway.org/report/industry-matters-smarter-energy-use-is-key-for-us-competitiveness-jobs-and-climate-effort