

Testimony of Noah Deich
Founder and Executive Director of the Center for Carbon Removal
centerforcarbonremoval.org

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The Utilizing Significant Emissions with Innovative Technologies (USE IT) Act

Executive Summary

Good morning to Members of the Committee, and thank you for your invitation to testify. I am the Executive Director of the Center for Carbon Removal, a non-profit based in the Bay Area of California.¹ Our mission is to advance innovative strategies for cleaning up carbon from the air in a way that helps halt climate change and build a growing, environmentally-sustainable economy.

I believe that the *USE IT* Act will help advance innovative carbon capture and use technologies, supporting the emergence of a new carbon economy based on cleaning up waste carbon in the air, and transforming carbon pollution back into a valuable resource. In this testimony, I will share why I believe the *USE IT* Act and other legislative efforts to advance a new carbon economy are so valuable, and why continued bipartisan support for this bill and others like it are essential to the future of a new carbon economy.

To begin, the carbon capture and use technologies supported by the *USE IT* Act offer a great opportunity for advancing domestic innovation and industrial job creation, as well as for U.S. climate leadership internationally. Carbon use is the idea of taking waste carbon -- be it from a power plant, an industrial facility like a cement or steel plant, or directly from the air -- and using it to produce valuable products. Many companies have already begun developing carbon use processes for products including: building materials such as cements and carbon fiber, and hydrocarbon fuels and chemicals that are mined from the sky, not the ground.

Direct air capture technologies are innovative carbon capture systems that use clean energy to filter carbon from ambient air -- not just smokestacks -- much like a plant does via photosynthesis. As a result, direct air capture systems can be integrated on-site at carbon

¹ Center for Carbon Removal website: www.centerforcarbonremoval.org

utilization or underground carbon storage projects, opening new possibilities for innovative manufacturing and carbon waste disposal businesses.

The *USE IT* Act is important for direct air capture and carbon use technologies for several reasons. First, these technologies are at a state of development that depend on public sector support to reach commercial maturity swiftly. Much like wind and solar energy in the 1980s, direct air capture and carbon use technologies would benefit greatly from sustained federal research, development, and commercialization support. Second, R&D support for these technologies complements and enhances the effectiveness of federal policy drivers like the 45Q tax credit, which was reformed earlier this year to include direct air capture and carbon use. Lastly, the increasing global demand for carbon use and direct air capture technologies suggests the window for leadership in this space is narrowing. For the U.S. to export -- not import -- direct air capture and carbon use systems in the decades to come, it is essential that the Federal government support domestic innovation and commercialization of these technologies today.

In conclusion, I would like to share my opinion that it is essential for the *USE IT* Act to move forward in a bipartisan manner. Bipartisanship is essential for the investors and companies that we work with to have confidence that legislation will remain durable to any future changes in Congressional leadership and Administrations. I have heard this directly in relation to the extension and expansion of the 45Q tax credits for carbon capture, use, and storage that were recently signed into law under to the bipartisan leadership of Chairman Barrasso and Senators Capito, Heitkamp, and Whitehouse. After this legislation was adopted, the startup incubator Y Combinator released a call for carbon use and direct air capture startups, citing 45Q as one reason for their interest.² Ensuring that the amendment process for the *USE IT* Act is done by consensus, and that language in the bill is bolstered to ensure it will not be used to weaken regulations that protect the environment, will be helpful to ensure the *USE IT* Act advances in a bipartisan manner and will form the foundation of a successful, long-term federal effort.

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

² Y combinator "Request for Startups" website: <https://www.ycombinator.com/rfs/#carbon> and Greentech Media article on the topic: <https://www.greentechmedia.com/articles/read/y-combinator-is-looking-for-carbon-removal-startups#gs.2GLaJgU>

Detailed Testimony

Direct air capture and carbon use are emerging industries

While government investment in carbon capture globally has historically focused on point-source capture (e.g. on fossil-fueled power plants and heavy industry), both carbon use and direct air capture are gaining increasing commercial traction.

On the direct air capture side, there are at least five privately-financed companies around the world that are currently commercializing direct air capture systems:

- Carbon Engineering (Canada)³
- Climeworks (Switzerland)⁴
- Global Thermostat (US)⁵
- Infinitree (US)⁶
- Skytree (Netherlands).⁷

In addition, there are significant direct air capture research efforts at a number of U.S. universities, including Arizona State University,⁸ and at National Labs, including Lawrence Livermore.⁹

On the carbon use side, there are a number of efforts in the US and beyond focused on developing new technologies and applications. There are dozens of companies developing carbon-derived products, including cements and concretes (e.g. Solidia and Carbon Cure), fuels, plastics, and/or chemicals (e.g. Opus12 and Newlight Technologies). Other strategies for carbon use involve using CO₂ to accelerate the production of algae, which can be used in agriculture, wastewater treatment, and specialty chemicals applications economically today.

The NRG Cosia Carbon XPRIZE¹⁰ has also fueled increased interest in commercialization of carbon use technologies, and is partnering with the Wyoming Infrastructure Authority's Integrated Test Center¹¹ for provide a hub of commercialization support around US carbon use solutions. In addition to the Carbon XPRIZE, there is increasing investor and startup interest in the carbon use space, as shown by efforts such as the Center for Carbon Removal's Carbon

³ Carbon Engineering website: <http://carbonengineering.com/>

⁴ Climeworks website: <http://www.climeworks.com/>

⁵ Global Thermostat website: <https://globalthermostat.com/>

⁶ Infinitree website: <http://www.infinitreellc.com/>

⁷ Skytree website: <https://www.skytree.eu/>

⁸ ASU Center for Negative Carbon Emissions website: <https://cnce.engineering.asu.edu/>

⁹ <https://www.llnl.gov/news/microcapsules-capture-carbon-safely>

¹⁰ Carbon XPRIZE website: <https://carbon.xprize.org/>

¹¹ Wyoming ITC website: <http://www.wyomingitc.org/>

Recycling Labs incubator program¹² and by analyses from groups such as the Breakthrough Energy Ventures investment coalition.¹³

Support today for direct air capture and carbon use are insufficient

Historically, both direct air capture and carbon use technologies have received little federal research and development support. A single direct air capture R&D effort by the U.S. Department of Energy funded about \$3M in projects. DOE has supported carbon use projects at roughly \$5-10M/yr recently, but this amount is still orders of magnitude less than federal funding provided for other types of carbon capture and storage and/or renewable energy systems. Since these efforts have been administered by the DOE's Office of Fossil Energy, the focus tends to be on large-scale commodity products that can use the vast quantities of CO₂ emitted by fossil-fired electricity generation. This framing detrimentally excludes higher-value, lower-volume products which offer more economically plausible first markets for the nascent carbon utilization industry.

One of the most significant policy advances for direct air capture and carbon use systems has been the recent reform of the 45Q tax credits to include both direct air capture and carbon use projects. These tax credits are essential market incentives, but additional federal R&D support is needed to drive direct air capture and carbon use system costs down to a price point that unlocks private capital to fuel their further commercialization and deployment.

Direct air capture and carbon use, along with a portfolio other carbon removal pathways, are essential for meeting climate goals and merit significant federal support on these grounds

Experts now agree that meeting climate goals will require the deployment of large-scale carbon removal strategies (also known as “negative emissions”) in only a few decades -- alongside the accelerated deployment of low-carbon energy, transportation, and industrial technologies. Carbon removal pathways -- i.e. strategies for removing and reliably sequestering carbon from the atmosphere -- can include direct air capture and carbon use technologies, as well as a portfolio of other natural and technological options. Other important carbon removal solutions include reforestation, blue carbon and wetland approaches, agricultural and soil carbon sequestration (including biochar), bioenergy production (for power, fuels, and/or heat) with carbon capture and storage (BECCS), and CO₂ mineralization (or enhanced weathering). The National Academies' 2015 study on “Carbon Dioxide Removal and Reliable Sequestration”¹⁴ outlines the promising pathways for carbon removal using both natural and technological solutions, and also explains why these strategies are essential for meeting climate goals. Many

¹² Carbon Recycling Labs website: <http://www.centerforcarbonremoval.org/carbon-recycling-labs/>

¹³ Breakthrough Energy Ventures website: <http://www.b-t.energy/landscape/manufacturing/>

¹⁴ National Academies Carbon Dioxide Removal and Reliable Sequestration website: <http://nas-sites.org/dels/studies/cdr/>

solutions on the natural carbon removal solution side also offer significant carbon removal and environmental co-benefit potential, as demonstrated by the “Natural Climate Solutions” study published in the *Proceedings of the National Academy of Sciences (PNAS)* journal in October 2017.¹⁵ It is essential to pursue a portfolio of federal R&D and policy support, to ensure that we can have the most resilient, flexible, and robust portfolio of carbon removal solutions in the future, as the Center for Carbon Removal outlined in our 2017 report on opportunities for federal action.¹⁶

To this end, there are a number of research efforts emerging to help inform the creation of a Federal portfolio of R&D around carbon removal strategies, including both direct air capture and carbon use. First, the National Academies will produce a follow up report to their 2015 study outlining R&D needs for the full portfolio of carbon removal strategies in 2018.¹⁷ In addition, a consortium of 12 universities and National Labs across North America have contributed to produce a “Roadmap for a New Carbon Economy,” also set for publication in 2018.¹⁸ This consortium of research institutions plans to begin executing on the R&D needs identified in the roadmap in 2018, and plans to scale research in the near future with increased funding from government, corporate, and philanthropic sources.

The U.S. is well positioned to be a world leader in the field of carbon use and removal. Immediate and sustained Federal support will be essential for solidifying this leadership for the decades to come, so that the economic and environmental benefits of these technologies accrue here at home.

¹⁵ Griscom, Bronson et. al (2017). “Natural Climate Solutions” in PNAS October 31, 2017. 114 (44) 11645-11650;. <http://www.pnas.org/content/114/44/11645>

¹⁶ “Carbon Removal Policy: Opportunities for Federal Action” Available at: <http://www.centerforcarbonremoval.org/policy>

¹⁷National Academies Study on Carbon Removal: <http://nas-sites.org/dels/studies/cdr/>

¹⁸ New Carbon Economy Consortium website: <http://www.centerforcarbonremoval.org/new-carbon-economy/>

The *USE IT* Act is aligned with the EPA's mission to protect human health and the environment

I believe that the *USE IT* Act provisions for funding direct air capture and carbon use R&D fit well under EPA's existing authority and capabilities. In the past, EPA has supported R&D and demonstration of control technologies for other air pollutants, such as SO_x and NO_x in power plant exhaust. Furthermore, EPA currently has a Small Business Innovation Research (SBIR) call out for carbon capture on vehicles. Mobile source carbon capture technology will likely have many similarities to direct air capture and carbon use systems.¹⁹

Other federal agencies have deep expertise researching and developing similar carbon capture technologies. If EPA coordinates and collaborates with these other federal agencies, and if Congress supports expanded carbon capture RD&D and collaboration across relevant federal agencies, it can yield more robust commercial activity on carbon removal strategies. DOE and EPA bring distinct but valuable capabilities to direct air capture and carbon use research, and I believe that a sustained effort from both agencies according to their respective strengths - with regular coordination - would be complementary and not duplicative.

Constructive suggestions for the *USE IT* Act to build bipartisan support

The Center for Carbon Removal collaborates with a number of environmental NGOs around policies related to carbon capture, use, and removal. The Center for Carbon Removal is a member of the Carbon Capture Coalition,²⁰ and we regularly convene and participate in meetings with other environmental NGOs outside of this coalition to discuss issues related to carbon capture. Based on conversations with stakeholders in the environmental NGO community about this bill, I believe that if certain elements were added to the bill language, it would increase support from environmental constituencies.

First, the bill could direct EPA to collaborate with other agencies that have carbon capture expertise -- and build off of the National Academies' forthcoming R&D reports on both direct air capture and carbon use technologies -- when designing and implementing the initiatives in Title I. This would help ensure that the direct air capture prize and carbon use R&D program maximize the impact of government funds.

Second, additional language to affirm that existing environmental laws -- including the Clean Air Act and the National Environmental Policy Act -- should not be weakened to advance direct air

¹⁹ EPA 2017 SBIR Solicitation topics: https://www.epa.gov/sites/production/files/2017-10/documents/epa_sbir_webinar_2017-18_solicitation_0.pdf

²⁰ Carbon Capture Coalition website: <http://carboncapturecoalition.org/>

capture and carbon use objectives would help assuage concerns from environmental groups that this bill could result in undermining valuable environmental protections.

Third, additional language could be added to Section 202 to highlight the importance for the new Task Force to assess the need for additional regulations and/or guidance to ensure the robustness of carbon storage and permanence. In our work with industry participants in carbon use, we hear firsthand that additional federal guidance on how their technologies and their potential environmental virtues are counted may be needed. For example, there is no consensus framework for life cycle analysis for carbon storage in building materials or consumer products.

Lastly, language could be added to clarify that the Direct Air Capture Technology Advisory Board may be inclusive of past recipients of EPA grant funding. The field of technology experts for DAC is brilliant but small, so any policy that could exclude some of the strongest potential participants from membership on this panel would be detrimental.

Conclusion

I would like to reiterate that this bill offers an important step forward for advancing direct air capture and carbon use technologies. I commend Chairman Barrasso and his co-sponsors, Senators Heitkamp, Capito and Whitehouse, for their leadership on this topic that is critical for meeting climate and economic goals in a robust and environmentally sustainable manner. Thank you again for the opportunity to submit this testimony.