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Field Hearing: The Future of Advanced Carbon Capture Research and Development

Subcommittee on Energy of the House Committee on Science, Space and Technology

United States House of Representatives

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Good Morning Chair Fletcher, Ranking Member Weber, members of the Committee…I sincerely thank you for the opportunity to testify before you today. My name is Nigel Jenvey and I work for Gaffney, Cline and Associates here in Houston, Texas as Global Head of our Carbon Management Practice.

Gaffney, Cline & Associates (GCA) was established in 1962, and provides technical, commercial, and strategic advice to the oil and gas industry. GCA operates worldwide from three main offices, in Houston, London, and Singapore, supported by regional offices in Buenos Aires, Sydney and Dubai.

Our new Carbon Management practice is specifically designed to meet our client's technical, strategic, and commercial needs to assess carbon & climate risks and opportunities to their business. This provides trusted, third party due diligence to our clients in their evaluations, reporting requirements, permit applications, and financial transactions.

A key pillar of our offering includes the assessment of the range of carbon solutions that are available to avoid, reduce, replace, offset or sequester Greenhouse Gases or CO_2 equivalent emissions in a cost-effective, time-based manner to ensure continued compliance and competitiveness in a constantly evolving global energy market.

While there is no silver-bullet to Carbon Management, Carbon Capture, Use and Storage (CCUS) is widely considered a vital carbon solution or clean energy technology that is available today, but according to the International Energy Agency reports on Tracking Clean Energy Progress, it is not on track for meeting the world's sustainable development goals. My objective today is to convey some of my experience on how continued U.S. technology and capability leadership will expand deployment domestically and internationally.

Historically most CCUS projects in the United States have been performed due to the commercial synergy that exists between the costs of transporting high concentration CO_2 that is vented from gas processing and ammonia production, to locations where revenues are available from large-scale use in Enhanced Oil Recovery (EOR) projects. With market-forces supplemented by 45Q tax credits having effectively developed most of these options, and recent 45Q tax credit enhancements laying a pathway to potentially add high concentration CO_2 from ethanol plants and include saline formation storage, additional CCUS technology and further deployment has focused on CO_2 capture from lower concentration sources.

A traditional view has been to focus on volume, with CO_2 capture from combustion based emissions at large-scale existing sources such as power plants. The CO_2 concentration in the flue gas from these plants typically ranges between 4-13% and is at or close to atmospheric pressure. Commercially available amine-based absorption technology is therefore capital intensive due to its large scale and complexity, along with significant energy and maintenance costs for operation. While cost and performance improvements have been achieved over time, they are now reaching fundamental limitations in the thermodynamics of the regeneration energy needed by the amine based solvents used in this process that has been in existence since the original patent for "A process for separating acidic gases" was filed by R.R. Bottoms in 1930. Cost reductions are therefore stalling.

An alternative approach has been to consider lower cost options, with CO_2 capture from a combination of process and combustion based emissions at medium-scale existing sources in industries such as cement, steel, and refining/petrochemicals. The CO_2 concentration in applicable streams from these plants typically ranges between 16-45%, and coupled with the potential for higher pressures, the size of capture equipment can be smaller, lowering the capital costs. However additional costs of integration of CO_2 capture equipment into these industrial processes, and lower economies of scale due to smaller sources, has not resulted in the significantly lower costs hoped for with currently available technology.

Other newer technology types include cryogenic, adsorption, membranes, and process systems that have been researched, developed and in some cases demonstrated at commercial scale over the last decade. Typically these technologies require less capital and have lower energy demand to operate than the incumbent commercially available technology. While some hold promise, deployment on commercial power plants or industrial facilities still has a significant amount of risk for investors due to total as spent cost and long term operational performance uncertainties.

A novel approach has therefore materialized, where some of these newer technologies are being demonstrated at much smaller-scales, with CO_2 capture from stationary emissions sources or directly from the air. Sometimes they are being combined into hybrid systems, or integrated with renewable power and heat sources. Innovation at this small, modular scale carries less risk, reducing cycle times to success or failure. While they are currently less mature, these innovations could potentially result in breakthroughs in cost that with further support and time potentially move back into power and large-scale industry applications.

We now understand that CCUS is a versatile carbon solution, in that it can greatly reduce CO_2 emissions from existing energy, industrial infrastructure, and the atmosphere. However, since there is no panacea for CO_2 capture technology to address all CO_2 emissions, a diversified technology program is therefore needed.

I have personally worked in CCUS since 2004 on technology and projects across the world, and have found unequivocally the U.S. to be the world leader in CCUS research, development, demonstration and deployment (RDD&D). This is evidenced by consistent congressional support over 20 years for the Department of Energy to lead and support public-private collaboration on science and technology, an established regulatory framework, over 5,000 miles of installed CO_2 pipelines, over 40 years of CO_2 EOR experience, over 80% of the world's installed CCUS capacity, and world leading policy support with the 45Q tax credit.

However the rest of the world is catching-up, with 12 of the next 15 projects in advanced development located outside the U.S. according to the Global CCS Institute.

Over the last year I have had the honor and pleasure to serve as Deputy Chair to the CCUS Study Coordinating Subcommittee of the National Petroleum Council. This study was undertaken at the request of Secretary Perry, and is due to report out on December 12th, 2019. The study had over 300 participants from more than 110 different organizations representing the oil and gas industry, other industries, consulting/financial companies, academia, NGOs and government. While I cannot comment on the specifics of this pending report, we have developed a roadmap for deployment at scale that will ensure continued U.S. leadership. A differential feature of the study has been to assess the costs to capture, transport and store the largest 80% of U.S. stationary sources. This has underpinned identification of the level of value necessary to enable deployment, builds the case for ongoing RD&D across the entire CCUS value chain, and enables assessment of the economic benefits (e.g. jobs, gross domestic product). The resulting recommendations have been laid out in three phases to achieve deployment at scale, and are categorized into financial incentives, supportive legal and regulatory frameworks, technology and capability, and stakeholder engagement themes. I offer to revert to this committee to provide further details of this study at a later date, should you be interested.

In conclusion, the U.S. is well-positioned to lead the world with its experience, technology and capability. Continued public-private commitments to RD&D investment are essential.

Thank you once again for your time today and I would be happy to answer any questions you may have.

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