Tiffany Roberts
Vice President, Regulatory Affairs

August 16, 2021

Ms. Rajinder Sahota
California Air Resources Board
1001 I Street
Sacramento, California 95814

Re: WSPA Comments on Engineered Carbon Removal Scoping Plan Workshop

Dear Ms. Sahota,

Western States Petroleum Association (WSPA) is a trade association that proudly represents energy companies that explore for, produce, refine, transport and market petroleum products, natural gas, and other energy supplies in California and four other western states. Currently 152,000 men and women have careers in the oil and gas industry in California and 366,000 people have careers whose jobs depend on the industry. The industry in California contributes $152 billion every year in economic activity and directly contributes $21.6 billion in in local, state, and federal tax revenue to support schools, roads, public safety and other vital services.

The way the world produces and consumes energy is evolving. And the members of WSPA are on the cutting edge of those changes, investing in and developing the diverse energy sources and technologies of the future. We believe that, working together, we can rise to the challenge of a changing climate.

During the August 2nd workshop, we were glad to see a robust conversation regarding various approaches to engineered carbon removal and the role these approaches can play in meeting the world's climate goals. We appreciate the opportunity to provide the below input.

Deployment of Engineered Carbon Removal Is Essential to Meeting Carbon Neutrality

There is consensus that the world will need engineered carbon removal to meet the goals of the Paris Agreements.

The Intergovernmental Panel on Climate Change (IPCC) has concluded that limiting global warming to 1.5°C with limited or no overshoot will require the use of Negative Emissions Technology (NETs). According to the National Academy of Sciences (NAS), recent analyses found that deploying NETs may be less expensive and less disruptive than reducing some emissions, such as a substantial portion of agricultural and land-use emissions and some transportation emissions. The NAS study finds, "Stopping the growth of atmospheric CO2 requires that anthropogenic emissions are less than or equal to natural and anthropogenic carbon sinks—**not that they cease altogether**."[1]

[1] Negative Emissions Technologies and Reliable Sequestration: A Research Agenda (2019). National Academies of Sciences, Engineering, and Medicine. https://doi.org/10.17226/25259

According to a September 2020 report by the International Energy Agency,[2] "Carbon capture, utilization and storage (CCUS) is the only group of technologies that contributes both to reducing emissions in key sectors directly and to removing CO2 to balance emissions that are challenging to avoid – a critical part of net zero goals."

In its 2020 analysis of the value of CCUS[3], the Global CCS Institute finds that CCUS is essential because it achieves deep decarbonization in hard-to-abate industries like cement, iron, and steel and that it can enable low-cost, low-carbon hydrogen production and is the foundation for technology-based carbon dioxide removal systems like direct air capture.

A recent White House Council on Environmental Quality report[4] states that to reach the President's ambitious domestic climate goal of net-zero emissions economy-wide by 2050, the United States will need to capture, transport, and permanently sequester significant quantities of CO2. The report also references that there is growing scientific consensus that CCUS and carbon dioxide removal (CDR) will need to play an important role in decarbonization efforts globally. "Action in the United States can drive down technology costs, accelerating CCUS deployment around the world."

The latest IPCC report[5] finds that CDR can compensate for residual emissions to reach net zero CO2 or net zero GHG emissions or, if implemented at a scale where anthropogenic removals exceed anthropogenic emissions, to lower surface temperature.

Furthermore, we are seeing that models will not solve without CCUS. Pre-2050 climate targets are impossible to meet without CCUS; and studies are showing that achieving post-2050 climate targets without CCUS would be dramatically more expensive. The growing consensus shows that in order to meet the climate challenge, scaled deployment of CCUS is imperative.

The Energy Futures Initiative's (EFI) 2019 report *Optionality, Flexibility, and Innovation: Pathways for Deep Decarbonization in California*[6] concluded that the targeted use of CCUS could be one of the largest single contributors to California's decarbonization by 2030 and contribute to deep decarbonization by midcentury as well.

CCUS can help the state significantly reduce carbon emissions from sectors such as crude production, refining, biofuels, cement manufacturing, power generation, agriculture, dairy, and others. In addition, the use of NETs enabled by and as a complement to CCUS will be crucial as highlighted by the recently released report by Lawrence Livermore National Lab[7] which identified ~100 MT CO2e/year of NETs projects in CA including bioenergy with carbon capture and sequestration (BECCS) and direct air capture (DAC). For context, if the full 100 MT CO2e/year of NETs identified by LLNL were built and operating, this would mitigate approximately ¼ of GHG emissions currently emitted in the state. This does not even take into account the potential for

[2] https://www.iea.org/reports/ccus-in-clean-energy-transitions
[3] https://www.globalccsinstitute.com/wp-content/uploads/2020/05/Thought-Leadership-The-Value-of-CCS.pdf
[4] https://www.whitehouse.gov/ceq/news-updates/2021/06/30/council-on-environmental-quality-delivers-report-to-congress-on-steps-to-advance-responsible-orderly-and-efficient-development-of-carbon-capture-utilization-and-sequestration/
[5] https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf
[6] https://static1.squarespace.com/static/58ec123cb3db2bd94e057628/t/5ced6fc515fcc0b190b60cd2/1559064542876/EFI_CA_Decarbonization_Full.pdf
[7] https://www.llnl.gov/news/new-lab-report-outlines-ways-california-could-reach-goal-becoming-carbon-neutral-2045

CCUS to reduce emissions from existing sources. A recent report by Stanford identified another 60 MT CO2e/year which could be reduced by applying CCS to industrial sources inside California[8].

Deployment of CCUS Technologies Will Lead to Reduction in Air Quality Impacts

During the workshop, some stakeholders expressed concerns that the deployment of CCUS projects across the state would lead to an increase in air pollutant emissions. We hear the concerns but note that there are factors which are not being considered. In fact, in many cases, CCUS projects will decrease air pollutant emissions.

First, when evaluating the potential impact on air quality from the deployment of CCUS projects across the state, it is critical to understand that most CCUS projects are likely to trigger both the California Environmental Quality Act (CEQA) and either the Nonattainment New Source Review (NNSR) or Prevention of Significant Deterioration (PSD) permitting processes.

- For CEQA, most projects will have to analyze for and inform governmental agencies and the public of a project's environmental impacts. If environmental impacts, such as an increase in air pollution, are identified the project must mitigate those impacts to less than significant levels as part of the project's approval.

- For NNSR/PSD, the project must analyze emissions increases on a pollutant-by-pollutant basis. For NNSR, which applies in non-attainment areas like Los Angeles or the San Joaquin Valley, the project must either net out any emissions increases with emissions decreases elsewhere at the facility or find emissions decreases (measured at a steep discount rate) inside the region where the project is set to occur to ensure at least no net emissions increases, if not net reduction, for the project. As such, carbon capture facility projects in the San Joaquin Valley and Los Angeles Basin may be subject to a higher threshold than projects in areas closer to achieving air quality attainment standards. For PSD, which applies in attainment (and unclassified) areas like Santa Barbara or many counties in northern California, the project must show that any emissions increase will not cause or contribute to a violation of any applicable NAAQS or PSD increment.

Second, while these permitting programs well describe the minimum requirements for CCUS projects from an air quality perspective, many CCUS projects will go further to reduce air emissions. For example, the LLNL report identified BECCS projects as some of the most promising in the state. These projects are expected to reduce local air quality impacts when compared to the open burning of agricultural or forest management wastes while creating electricity or hydrogen.

Energy Companies Seeking to Deploy Engineered Carbon Removal

WSPA member companies are in the process of designing and permitting facilities that could benefit California. Just a few examples include:

- California Resources Corporation (CRC) previously announced a 2030 Sustainability Goal to install carbon capture on its 550 MW power plant at Elk Hills Field and further to sequester 1.4MM Metric Tons per year within the field.

[8] https://sccs.stanford.edu/sites/g/files/sbiybj7741/f/efi-stanford-ca-ccs-full-rev1.vf-10.25.20.pdf

- Aera Energy, LLC has a strategic goal of reducing its carbon intensity by mid-decade and is developing a project at its Belridge Production Complex in Kern County to capture and sequester nearly 200,000 metric tons per year initially and ramping by the end of the decade to substantially increase those stored emissions.
- Chevron, Schlumberger New Energy, Microsoft, and Clean Energy Systems announced plans to develop a BECCS project designed to produce carbon negative power in Mendota, California. The BECCS plant will convert agricultural waste into a renewable synthesis gas. More than 99% of the carbon from the BECCS process is expected to be captured for permanent storage by injecting CO2 underground into nearby deep geologic formations. By using biomass fuel that consumes CO2 over its lifetime to produce power and then safely and permanently storing the produced CO2, the process is designed to result in net-negative carbon emissions. The plant is expected to remove about 300,000 tons of CO2 annually.
- Valero Energy has announced that it is partnering with Navigator Energy Services to build an industrial-scale carbon capture pipeline system across five Midwest states that could permanently sequester up to 8 million metric tons of CO2 annually. Lower CI fuels produced from facilities participating in the sequestration project could easily be transported to California for use in the transportation sector.

Further insight into the role of CCUS in meeting California's net-neutrality goals and the efforts WSPA member companies are engaged in to pursue this effort are outlined in a CCUS fact sheet, which has been attached for your reference in Appendix A. But significant barriers to deployment exist in California. We provided extensive comments regarding these barriers in a prior letter and have included that as an attachment to this letter as well in Appendix B.

Conclusion

We are very supportive of engineered carbon removal technologies. The state has an opportunity to take a leadership role in this area. Ultimately policymakers should support, pursue, and implement policies that will foster technological and regulatory environments that further encourage substantial development and deployment of carbon dioxide removal. Doing so could create a foundational framework that would attract more investment into the market and could increase deployment of these technologies – which would help the state achieve its long-term climate goals.

We ask that CARB and the state implement early, significant, and sustained deployment of CCUS. In support of this unique leadership position held by the California Air Resources Board (CARB) we strongly support the inclusion within the 2022 Scoping Plan Update, models which rely upon significant CO2 removal as a primary strategy for meeting the state's 2045 carbon neutrality goal. We also encourage CARB to include within the Scoping Plan Update their intent to pursue the statutory and regulatory amendments necessary to mitigate the barriers as previously identified

Thank you for consideration of our comments. We would welcome the opportunity to discuss these ideas in more detail with you. We look forward to working with you on these important issue areas.

Sincerely,

Tiffany K. Roberts,
Vice President, Regulatory Affairs
Western States Petroleum Association

APPENDIX A

WSPA™

Factsheet

A Case for Carbon Capture, Utilization and Sequestration Technologies

Carbon Capture, Utilization and Storage or Sequestration (CCUS) encompasses a set of proven technologies that permanently remove CO_2 from our atmosphere, predominantly by sequestering it securely underground.

The importance of CCUS has been recognized globally since early applications began in the late 1970s and the 1980s as a critical solution to meeting our emissions-reduction goals. There are 26 projects in operation around the world today. During 2020, 12 new large-scale facilities in development were added to the Institute's project database from the United States alone, but none in California.[1] It is essential that California develop a predictable, sustainable, and cogent roadmap for CCUS in order to achieve our 2045 carbon neutrality goals.

CCUS IN NUMBERS

26

large-scale CCUS facilities operating globally. 39 more in development.[2]

These 26 facilities have a CO_2 capture capacity of **40 million tonnes** per annum (Mtpa)

CCUS is the only technology able to decarbonise the industrial sector

17 new commercial facilities entered the project pipeline globally since 2019. 12 of 17 in the U.S.

The Situation

Over the next two decades, global population and gross domestic product (GDP) are expected to grow significantly. Many outlooks anticipate a 25% to 30% increase in global energy demand in the next two decades as well as a need to address rising greenhouse gas (GHG) emissions.[3]

The National Petroleum Council states in their 2019 roadmap report that as global economies and populations continue to grow, the world faces the dual challenge of providing affordable, reliable energy while addressing the risks of climate change.

1 Global CCS Institute "Global Status of CCS 2020" https://www.globalccsinstitute.com/wp-content/uploads/2020/12/Global-Status-of-CCS-Report-2020_FINAL_December11.pdf
2 Global CCS Institute "Global Status of CCS 2020" https://www.globalccsinstitute.com/wp-content/uploads/2020/12/Global-Status-of-CCS-Report-2020_FINAL_December11.pdf
3 NPC Report 2019 "Meeting the Dual Challenge: A Roadmap to At-Scale Deployment of CARBON CAPTURE, USE, AND STORAGE" https://dualchallenge.npc.org/

The Solution

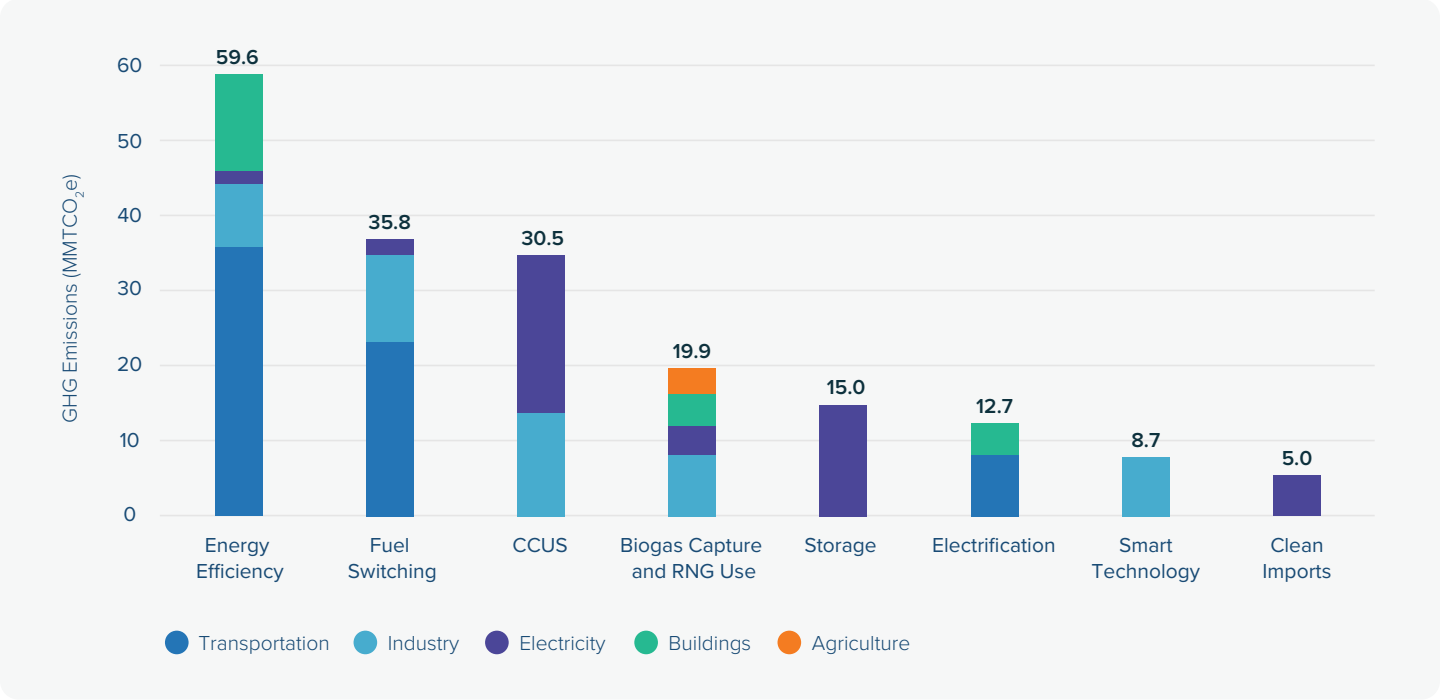
According to the International Panel of Climate Change (IPCC) September 2019 report, Global Warming of 1.5°C, net-zero CO_2 emissions are not credibly achievable without major contributions from negative-carbon technologies.[3]

The Global CCS Institute (GCCSI) thinktank cites the IPCC's studies, as well as those from the International Energy Agency, as evidence of the critical role that CCUS must play in meeting our global emissions reduction goals.

Simply put, CCUS is a "climate game-changer."[4] As one of the few technologies able to cost-effectively mitigate CO_2 and reduce or eliminate emissions from large-scale industrial sources, CCUS has the unique capacity to deliver commercial returns in a new energy economy where technologies like hydrogen production and bioenergy are starting to gain traction.

For California, CCUS is among the top three strategies for decarbonizing, according to the Energy Futures Initiative. Most scientists say that without these, according to EFI, "there's no way we will limit global warming to the 1.5-to-2-degree Celsius target set in the 2015 Paris Agreement" and emissions are still going in the wrong direction. While carbon capture is not "a silver bullet solution, it is an important tool for reversing this harmful trend."[5]

EFI also notes that every one of these strategies is critical and needs to be on the table as we continue discussing viable pathways to reach our climate goals.



Source: EFI 5/19 Pathways for Deep Decarbonization in California, Energy Futures Initiative]

3 Intergovernmental Panel on Climate Change (IPCC) 2019 Report https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Summary_Volume_Low_Res.pdf ; and Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf

4 GCCSI https://www.globalccsinstitute.com/why-ccs/

5 Energy Futures Initiative https://energyfuturesinitiative.org/; Clearing the Air Report 2019; CCS Fact Sheet "Everything You Wanted to Know About Carbon Capture"

The Urgency

Is CCUS really needed now, at a time when we are seeing remarkable improvements in the cost and performance of key renewable technologies like solar and wind? The answer is unequivocally, yes.

Great strides have already been made and California's 2030 climate targets are within reach, but CCUS will be integral to achieving the state's aggressive Carbon Neutrality goals. International climate change bodies (IPCC and IEA) confirm that CCUS is essential to mitigating climate change and reinforce the fact that our targets cannot be reached without deployment of all clean technologies, including CCUS.[6]

The technology and the oil and gas industry's role and readiness for CCUS are strategic imperatives. But while the industry is technically ready to be part of the solution moving forward, the state has some policy hurdles to overcome to get CCUS up and running, such as:

- ✓ Creating a single source permitting process
- ✓ Clearing a predictable, sustainable credit pathway
- ✓ Considering CCUS within the Cap & Trade program structure
- ✓ Creating a streamlined CEQA process

The reason why it is so critical to address these barriers now is because the size of the required negative emissions is daunting, according to a June 2020 report titled "Getting to Neutral" from Livermore Laboratory Foundation and the ClimateWorks Foundation.[7] Worldwide, the report states, we will need to remove around 1 billion tons of CO_2 in 2030, 10 billion tons in 2050, and 20 billion tons in 2100.

100x

To achieve these emissions targets, the number of industrial scale CCUS projects would need to increase a "hundredfold" to more than **2,000 sites needed globally by 2040** — according to the IEA's World Energy Outlook 2019 report.[8]

California can pioneer these technologies and take the lead in deploying CCUS as a real, viable climate solution, if we can act on this opportunity now and continue building on our long history of aggressive policies for energy efficiency, renewables and carbon reduction.

A Case for Cost Efficiency

CCUS is a more cost-effective way than most to address climate change and will help California be a "Climate Leader," if it can significantly catch up with the rest of the world. The case for cost efficiency is examined in the GCCSI report[9], stating CCUS is cheaper than intermittent renewables on a like-for-like total system cost basis, and costs continue to decrease as more facilities commercialize. The report states: "Since the Boundary Dam CCS facility in Canada began operations in 2014, savings of as much as 30% have been identified for construction of a like (or follow-up) facility. This demonstrates the declining costs of deployment. As a simple law of economics, costs will continue to fall as more facilities come onstream. What is expensive is not doing anything at all."

6 GCCSI https://www.globalccsinstitute.com/wp-content/uploads/2020/07/Global-CCS-Institute_KeyMessages_2020.pdf

7 Livermore Laboratory Foundation and the ClimateWorks Foundation report "Getting to Neutral, Options for Negative Carbon Emissions in California" https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf, August 2020

8 "World Energy Outlook 2019." International Energy Agency, Nov. 2019 https://www.iea.org/reports/world-energy-outlook-2019. Accessed 29 May 2020.

9 GCCSI "Global Status of CCS: 2017 – Join the Underground" 2017 https://www.globalccsinstitute.com/wp-content/uploads/2018/12/2017-Global-Status-Report.pdf

Grounded in Facts

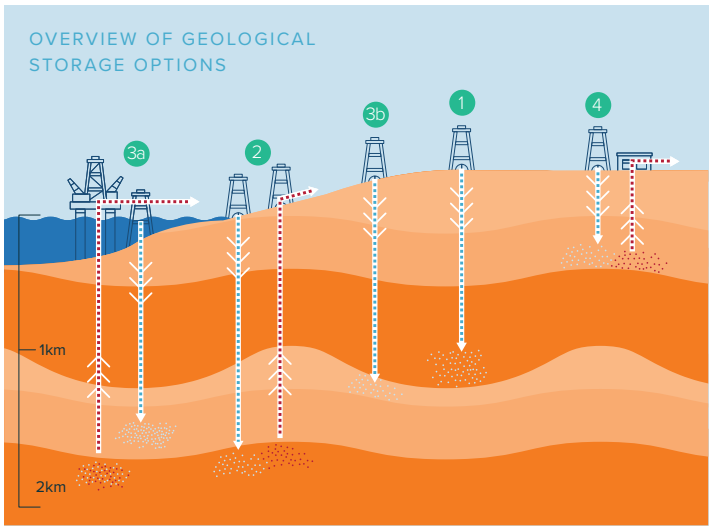
Underground CO_2 storage capacity has been the big question to date, with many assuming it is one of the biggest challenges impeding the acceleration of CCUS facilities, but the reality is there is more underground storage capacity than is actually needed to meet current climate targets.

In particular, California's reservoirs are well-suited for carbon storage because they have the pore space and optimal geology. According to Steve Bohlen, California's State Geologist, in testimony provided to the California Legislature Senate Committee on Environmental Quality Hearing on California's Climate Change Policies in February of 2019[10], California is blessed with excellent geology, and studies indicate that the state's depleted hydrocarbon reservoirs alone could sequester over 2 billion tons of CO_2, which equates to 20 years at 50 million tons of CO_2 per year. These reservoirs are well understood and have existing infrastructure that could enable rapid deployment of CCUS.

In fact, the GCCSI reports a large proportion of the world's key CO_2 storage locations have now been vigorously assessed and almost every high-emitting nation has demonstrated substantial underground storage capacity.

Furthermore, the National Petroleum Council states in their Roadmap for CCUS deployment that most of the lower 48 states have some subsurface CO_2 storage potential. While estimates of U.S. storage vary, experts generally agree that it is adequate to store hundreds of years of CO_2 emissions from U.S. stationary sources.

For the oil and gas industry specifically, storage capacity in California is already well established, and according to IPCC policy maker summary report[11], the technologies needed for CCUS are already compatible with most current energy infrastructures.



IPCC: Figure SPM.4. Overview of geological storage options (based on Figure 5.3) (Courtesy CO_2 CRC).

"

We see CCS as a proven, viable technology to help the state in both the short and long the term to deal with industrial and transportation emissions, as well as a critical enabler for carbon-neutral or carbon-negative solutions...The stark reality of climate change and the extreme urgency to reduce emissions in California and globally demand that we include CCS in our portfolio and take proactive steps to deploy it alongside the many other tools."

Steve Bohlen

CALIFORNIA'S STATE GEOLOGIST

10"California Legislature Senate Committee on Environmental Quality Hearing on California's Climate Change Policies February 20, 2019" https://senv.senate.ca.gov/sites/senv.senate.ca.gov/files/llnl-ar-768148.pdf

11 IPCC Policy Maker Summary Special Report https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_summaryforpolicymakers-1.pdf

The Definitions

CCUS is among the technologies that most scientists say that without it, there's no way we will limit global warming to the set targets. CCUS supply chains can have many forms, but here are the building blocks:

CAPTURE

CO_2 is produced in combination with other gases during industrial processes, including hydrocarbon-based power generation, or is captured directly out of the air. CO_2 capture involves the separation of the CO_2 from these other gases. This separation can be accomplished using many different technologies, the most common of which is amine absorption. Once the CO_2 is separated, it is typically dehydrated to avoid corrosion and then compressed or refrigerated so that it behaves like a liquid, making it ready for transport.

USE

While most CO_2 captured over the next few decades will likely be stored, it can also be used to produce valuable products and services. Examples of CO_2 use include building materials, carbon nanotubes and syngas, which is a synthetic gas mixture of hydrogen, carbon monoxide and very often carbon dioxide. CO_2 use is currently an outlet for only a small fraction of the captured CO_2, but may provide a meaningful option with further market and technology development.

TRANSPORT

In most cases, captured CO_2 will need to be transported from the capture location to a different location where it can be stored or used. This can be accomplished by using pipelines operating at a pressure that enables the CO_2 to remain in a dense phase. Alternatively, CO_2 can be transported using rail, trucks, or marine vessels.

STORAGE

There are multiple pathways for CO_2 storage. Compressed CO_2 is injected into carefully selected subsurface geological formations for safe, secure, and permanent storage. CO_2 can also be used to produce oil in a process known as enhanced oil recovery (EOR). Operational experience indicates that approximately 99% of the CO_2 used in EOR is ultimately trapped in hydrocarbon-producing geologic formations.

The Industry's Role

The oil and natural gas industry is at the forefront of CCUS and stand ready to tackle this immense challenge and significantly increase the deployment. The industry has the people and leaders with the right expertise and experience to identify and evaluate the subsurface for safe storage of CO_2, manage large-scale permitting of projects, efficiently procure materials and manage supply chains, construct large-scale capital-intensive projects, and safely operate complex facilities. Additionally, in many locations the industry has well-situated infrastructure already in place for handling large volumes of gas and liquids.

California's oil and gas industry is no stranger to innovation and is uniquely positioned to lead in this task, with a long history of aggressive policies for efficiency, renewable energy and carbon reduction, along with geology and a leading workforce ideally suited to the task.

By all accounts, there is no doubt that large-scale CCUS technologies will require significant investment and the cooperation of multiple industries and government working together. With the oil and gas industry's leadership, expertise, and infrastructure, overall costs will come down over time as more research is done, the technology continues to develop, and efficiencies are born out of economies of scale. Over the long term, CCUS investments will promote economic growth, create domestic jobs, protect the environment and enhance energy security.

Laying the Groundwork

The oil and gas industry is working to advance the technologies for CCUS by continuing to pursue the practice as a recognized solution essential to meeting our global emissions reduction goals.

Partnering on hundreds of projects to increase the understanding of the science, engineering application, and economics of CCUS, WSPA'S member companies continue to fund research and development in support of proven and emerging CCUS technologies to bring this vision to life for a more sustainable energy future for us all. Here are some examples:

Chevron is one of the leading energy companies working to advance the technologies that will underpin the deployment of industrial-scale CCUS. The company has invested approximately $1.1 billion in CCUS projects that are expected to reduce GHG emissions by about 5 million metric tons per year, roughly equivalent to the GHG emissions of 620,000 U.S. homes' annual electricity usage.

California Resources Corporation is actively designing and permitting California's first CCUS project and will be sequestering carbon by mid-decade. This project will capture CO_2 from the 550 MW Elk Hills Power Plant and inject into underground oil formations, displacing remaining oil and permanently trapping CO_2. This project will have far-reaching economic benefits for both Kern County and California as well as proving the commercial viability of CCUS for a natural gas combined cycle power plant.

ExxonMobil is the world leader in carbon capture, capturing more CO_2 than any other company since 1970 and working on a portfolio of carbon capture technologies in collaboration with others. Since 2000, ExxonMobil has invested approximately $10 billion in projects to research, develop and deploy lower-emission energy solutions. The company continues to expand collaborative efforts with more than 80 universities, five energy centers and multiple private sector partners around the world to explore next-generation energy technologies. Recently the company announced that its scientists, along with the University of California, Berkeley and Lawrence Berkeley National Laboratory, have discovered a new material that could capture more than 90% of CO_2 emitted from industrial sources, such as natural gas-fired power plants, using low-temperature steam, requiring less energy for the overall carbon capture process.

In 2019, **Shell** successfully completed a one-year pilot project to separate CO_2 from the exhaust gases of a biomass power plant in Vienna, Austria. The project captured 0.7 tons of CO_2 per day. In its first four years of operations, Shell and its global partner Quest captured and safely stored deep underground more than 4 million tons of CO_2, ahead of schedule. That is roughly equal to the emissions from about one million cars. For its facility in Canada's Alberta flatlands, Quest has stored more CO_2 than any other onshore CCUS facility with dedicated geological storage in the world. It is a milestone that has been reached ahead of schedule and at a lower cost than expected.

Valero Energy Corporation and BlackRock Global Energy & Power Infrastructure Fund III are partnering with Navigator Energy Services to develop an industrial scale carbon capture pipeline system ("CCS"). The initial phase is expected to span more than 1,200 miles of new carbon dioxide gathering and transportation pipelines across five Midwest states with the capability of permanently storing up to 5 million metric tonnes of carbon dioxide per year. Pending third party customer feedback, the system could be expanded to transport and sequester up to 8 million metric tonnes of carbon dioxide per year.

"This exciting advance for carbon capture technology is an outstanding example of how scientists with diverse expertise from universities, national labs, and industry can come together to solve fundamental research challenges. We are grateful to have had such long-term research support from ExxonMobil, without which this discovery would not have been possible. I hope this success will serve to encourage further partnerships between industry and academic research labs."

Jeffrey Long

PROFESSOR OF CHEMISTRY & CHEMICAL AND BIOMOLECULAR ENGINEERING, UNIVERSITY OF CALIFORNIA, BERKELEY
FACULTY SENIOR SCIENTIST, LAWRENCE BERKELEY NATIONAL LABORATORY.

APPENDIX B

WSPA

Catherine Reheis-Boyd
President

March 26, 2020

Ms. Rajinder Sahota
California Air Resources Board
1001 I Street
Sacramento, California 95814

Re: WSPA Comments on Carbon Neutrality/CCS Workshop

Dear Ms. Sahota,

Western States Petroleum Association is a trade association that proudly represents companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas, and other energy supplies in California and four other western states. Currently 152,000 men and women have careers in the oil and gas industry in California and 366,000 people have careers whose jobs depend on the industry. The industry in California contributes $152 billion every year in economic activity and directly contributes $21.6 billion in in local, state, and federal tax revenue to support schools, roads, public safety and other vital services.

During the CARB Carbon Neutrality/CCS workshop, we were glad to see a robust conversation regarding various approaches to carbon capture, utilization, and sequestration (CCUS) and the role these approaches can play in meeting the state's climate goals. In the past, WSPA has provided significant comment regarding the CCUS protocol in the state's Low Carbon Fuel Standard. In addition to those comments provided to date, we offer additional input below.

CCUS Will Play an Important Role in Carbon Neutrality
The way the world produces and consumes energy is evolving. And the members of Western States Petroleum Association are on the cutting edge of those changes, investing in and developing the diverse energy sources and technologies of the future. We believe that, working together, we can rise to the challenge of a changing climate.

The Intergovernmental Panel on Climate Change (IPCC) has concluded that limiting global warming to 1.5°C with limited or no overshoot will require the use of Negative Emissions Technology (NETs) by the middle of this century. According to the National Academy of Sciences (NAS), recent analyses found that deploying NETs may be less expensive and less disruptive than reducing some emissions, such as a substantial portion of agricultural and land-use emissions and some transportation emissions. A recent NAS study finds, "Stopping the growth of atmospheric CO2 requires that anthropogenic emissions are less than or equal to natural and anthropogenic carbon sinks—**not that they cease altogether**."[1]

CCUS can help the state significantly reduce carbon emissions from many sectors (oil production, refining, biofuels, cement manufacturing, power generation, agriculture, dairy, etc.). WSPA member companies are in the process of designing and permitting facilities to accomplish this.

[1] Negative Emissions Technologies and Reliable Sequestration: A Research Agenda (2019). National Academies of Sciences, Engineering, and Medicine. https://doi.org/10.17226/25259

For example, California Resources Corporation (CRC) has developed a 2030 Sustainability Goal to install carbon capture on its 550 MW power plant at Elk Hills Field and further to sequester 1.4MM Metric Tons per year within the field. In addition, the use of NETs enabled by and as a complement to CCUS (and as highlighted by the recently released report by LLNL), will also be crucial. Therefore, at a high level, policy makers should pursue and implement policies that will foster technological and regulatory environments that further encourage substantial CCUS project development and deployment.

Four Categories of Barriers to CCUS Development

Because of California's unique geology, the state is a prime location to deploy CCUS projects. But there are barriers that need to be addressed in order to create the right environment to encourage these technologies to proliferate. Those barriers fall into four categories: 1) Permitting; 2) Financing Uncertainty; 3) Lack of Infrastructure; and 4) Legal Uncertainty. We discuss each of these in the below sections.

Permitting - One of the major obstacles to increasing CCUS project deployment in California is the complicated spiderweb of permitting requirements that exists across state, regional, and local regulatory bodies. Currently permitting CCUS projects involves several departments and agencies at the state and local government level. As an example, for CCUS associated with a power plant, the following types of activities and permits (among many others) would be needed.

Local Government	Air District	CalGEM/Water Board	CARB
Installation of carbon capture equipment - the tower could exceed a height limit so this would need a variance which requires a conditional use permit.	Permits through the air districts for new emissions points	Injection wells would require involvement of agencies, such as CalGEM (California Geologic Energy Management) and county environmental agencies to administer environmental impact reports and well permits for Class II wells associated with EOR. Class VI injection wells required for non-EOR applications would need development of a new permitting process with approval from the US EPA.	Because the state's LCFS program contains a CCUS protocol, approved pathways will be required. CARB will need to be very active in this space.
Injection wells would require involvement of agencies, such as CalGEM (California Geologic Energy Management) and	Amine (liquid) capture: liquid in contact with flue gas to extract CO2 and let nitrogen through would trigger the	Permitting for production	

county environmental agencies to administer environmental impact reports and well permits for Class II wells associated with EOR. Class VI injection wells required for non-EOR applications would need development of a new permitting process with approval from the US EPA.	need for an air permit.		
County will be charged with CEQA review of project. Need a conditional use permit for sequestration process.	This process requires steam therefore a steam boiler or modification of currently existing steam boilers may be necessary. The boiler would require a permit.		

The state needs a regulatory structure that will encourage deployment of projects. The state should consider ways to streamline the permitting process such as through establishing a one-stop shop that could reduce the iterative process with state agencies. Greater regulatory certainty would create more development interest which in turn would drive more competition and ultimately help drive down costs of deployment.

Recommendation: The state needs strong leadership on CCUS as well as a clear framework for processing and approving projects. Such a framework should coordinate and streamline connectivity between various regulatory aspects of the approval process at the state, regional, and local level.

Financing Uncertainty – A lack of certainty by project developers with respect to their ability to secure financing discourages development and deployment of CCUS opportunities. Please see the attached comments from past LCFS rulemakings for WSPA's comprehensive set of comments on the CCUS protocol. In addition, we believe there are additional considerations CARB should make on this issue.

The LCFS credit price may provide an incentive for deployment of CCUS, particularly when combined with the 45Q federal tax credits for CCUS projects. But there is a fundamental disconnect in the incentive structure. For example, concerns regarding the 100-year post-injection liability have been raised that bear repeating. At its heart, the 100-year liability is one of the largest hurdles to large scale adoption of CCUS as it disincentivizes investors to fund projects. Additionally, and equally as important, the science supports the idea that if there is going to be

leakage, it will happen early on and that the risk of leakage diminishes with time. We continue to advocate for reconsideration of the length of liability. Furthermore, CARB requires that a buffer account be in place as insurance against potential leakage. There is no need for the redundancy of potential liability, nor the significant cost penalty this would place on projects, thus reducing their economic viability.

Even if the CCUS protocol under the LCFS is not changed, there is the opportunity for California to take action to further incentivize CCUS through creative approaches. States like Louisiana and North Dakota have laws where the state will take some of the liability associated with the sequestration. This type of policy incentivizes CCUS projects in those states and California could follow suit. Additionally, California itself could be involved solely or through a public/private partnership to undertake the sequestration and/or jointly share in the liability. Regardless of which approach the state decides to take, it is critical that the 100-year liability is addressed in a meaningful way or investment in CCUS will be stifled.

In addition to the LCFS CCS protocol, CARB should also consider ways to incentivize development and deployment of CCUS through the state's cap-and-trade program. It could do so by ensuring that the mandatory reporting requirement (MRR) recognizes reduced emissions from CCUS projects. Currently, MRR emissions are reported via fuel consumed, but there is no mechanism to properly account for emissions subsequently captured/sequestered.

Another critical incentive would be a protocol for entities to take a positive credit for the application of negative emissions technologies. WSPA suggests this could be done through the creation of a protocol to generate an "emission removal credit" which could be fully fungible with a cap-and-trade or offset credit. CARB should take a similar approach to applications of CCUS technologies which remove more carbon from the atmosphere than they emit, thereby allowing the value of carbon removed to provide a critical economic incentive to the operator.

The state could also consider additional incentive opportunities through GGRF funding or other climate funding mechanisms. Outside of GGRF or other climate funding mechanisms, other states have offered tax breaks and/or low interest loans as a way to get carbon capture projects underway. While we will have more to say on this issue in future comment letters, we do believe that it is now time for the state to begin a conversation on how other existing regulatory and incentive structures can be aligned in order to fully incentivize CCUS deployment.

Recommendation: CARB should evaluate how fixes to the LCFS and other regulatory programs can create greater financing certainty for CCUS projects. Additionally, the legislature should be discussing what funding incentives can and should be offered to foster carbon capture projects.

Lack of Dedicated CO2 Pipeline Infrastructure - Refiners and other industrials who may be interested in exploring opportunities to capture CO2 on-site at their facilities face a significant barrier due to a lack of local storage options (most large in-state CO2 sources are not in locations where CO2 injection is geologically possible) and poor CO2 transportation options to the locations where the geology supports sequestration.

Pipelines are generally the most cost-effective means of transport, but there is currently a lack of pipeline infrastructure to move CO2 from capture to storage. Therefore, CO2 sources are unlikely to devote significant resources to capture the CO2 unless there is a secured transportation network for the CO2. This creates a bit of a "chicken and egg" situation in that, without a secured source of CO2, it is unlikely that a CO2 transportation project would be undertaken.

It is critical from a business perspective that capture, transport, and sequestration come online and be fully operational at the same time. However, under the existing structure, the permitting, construction and commissioning of these three separate projects – which are likely to be owned by separate entities - is unlikely to sync up and delay of any one project would mean that the other two projects could be put at financial risk. For example, these projects could face legal challenges which could lead to delays that could strand capital invested in all three projects for long periods of time, putting all three projects at risk. As such, under the existing permitting, regulatory, and legal structure, there is significant financial risk associated with CCUS.

As an example of this challenge, some pipelines exist to support enhanced oil recovery (EOR), but there is no gathering network to link EOR opportunities with CO2 sources. CO2 transportation infrastructure will be critical to activate this type of CCUS application in the state. There are locations in the state which are prime for EOR, but CO2 sources may not exist in close proximity. This is the case in San Joaquin Valley as several oil fields there appear to be suitable for EOR. This is different than the Permian which has geologic CO2 sources close by oil and gas operations well suited for EOR. While this is an example from upstream oil and gas production, we would note that the downstream refining sector also faces similar challenges.

Recently stakeholders have begun to discuss the idea of CO2 collection hubs as a solution to this issue. While hubs are more complicated to implement, a hub concept has significant advantage in that it provides economies of scale for all involved. The hub would allow multiple sources of CO2 to all take advantage of potentially a single pipeline and a single sequestration site. Large CO2 pipelines needed to support a hub would also allow smaller sources of CO2 along the pipeline route to capture and sequester their CO2 as well.

Absent CO2 pipeline infrastructure, other options are simply not cost-effective for large scale deployment. Bulk movement by rail, where possible, would be expensive and would quickly erode the value of potential projects. Trucking of CO2 may be possible though it is likely an even more expensive alternative that would burden project economics with additional emissions (both GHG and NOx/Sox) as well as raise additional permitting and road traffic safety concerns. If the state wishes to bring CCUS to scale across several industrial settings, it seems most reasonable to do so via pipeline infrastructure in a hub and spoke model.

Recommendation: CARB and the state should play a key enabling role to support and improve the synchronization of this process. The state should consider how a hub and spoke concept to CCUS pipeline infrastructure would incentivize additional deployment of the technology. The state should also work with the private sector to identify locations that would best serve as a gathering point for such a network and understand the prime locations for sequestration.

Legal Issues – In addition to the above barriers, there are several legal issues that exist regarding CCUS implementation. These issues include legal questions around liability and pore-space ownership, CO2 ownership, unitization, and primacy rights. These issues are complicated, but the state will need to begin facilitating conversations on these legal questions in order to successfully advance CCUS deployment.

Recommendation: The state should assemble a team of legal experts who can begin to address and answer these legal questions.

Conclusion

We are very supportive of CCUS and want to see this technology deployed. The above discussion illustrates some of the practical challenges that need to be addressed. The state has an

opportunity to take a leadership role in each one of these areas. And doing so could create a foundational framework that would attract more investment into the market and could increase deployment of these technologies – which ultimately would help the state achieve its long-term climate goals.

Thank you for consideration of our comments. We would welcome the opportunity to discuss these ideas in more detail with you. If you have any immediate questions, please contact me or my staff, Tiffany Roberts, Director, Legislative and Regulatory Policy at troberts@wspa.org or 415-235-8741. We look forward to working with you on these important issue areas.

Sincerely,

Catherine Reheis-Boyd,
President
Western States Petroleum Association

cc: Jared Blumenfeld
Wade Crowfoot