SENATE COMMITTEE ON ENVIRONMENTAL QUALITY
Senator Allen, Chair
2021 - 2022 Regular

Bill No:	SB 1101		
Author:	Caballero		
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Urgency:	No	**Fiscal:**	Yes
Consultant:	Jacob O'Connor		

SUBJECT: Carbon sequestration: pore space ownership and Carbon Capture, Utilization, and Storage Program

DIGEST: Requires the Air Resources Board to establish a Carbon Capture, Utilization and Storage (CCUS) program for developing the commercial application of CCUS technologies and equipment. Specifies the definition of free space in existing property rights includes pore space that can be possessed and used for the storage of gaseous or liquid substances.

ANALYSIS:

Existing law:

1) Establishes the Air Resources Board (ARB) as the air pollution control agency in California and requires ARB, among other things, to control emissions from a wide array of mobile sources and coordinate, encourage, and review the efforts of all levels of government as they affect air quality. (Health and Safety Code (HSC) §39500 et seq.)

2) Requires ARB to reduce greenhouse gas emissions (GHG) to 40% below 1990 levels by 2030. (HSC§38566)

3) Establishes a low carbon fuel standard which will reduce the carbon intensity of the transportation fuel pool used in California. (17 California Code of Regulations §95480 et seq.)

4) For the purposes of ownership, defines land as the materials of the earth including free or occupied space for an indefinite distance upwards as well as downwards, subject to limitations upon the use of airspace imposed by law. (Civil Code (CIV) 659)

5) Defines a skilled and trained workforce as a workforce that meets these conditions: (Public Contract Code §2601)

a) All workers performing work in an apprenticeable occupation are either skilled journeypersons or registered apprentices;
b) Skilled journeypersons have either graduated from an apprenticeship program approved by the state or by the federal government or have at least as many hours of on-the-job experience as would be required to graduate from an apprenticeship program for the occupation; and
c) At least 60% of skilled journeypersons employed on the project are graduates of an apprenticeship program for the applicable occupations except for specific occupation where the requirement is 30%.

This bill:

1) Defines "CCUS" to mean carbon capture, utilization, and storage technology or equipment used for controlling carbon dioxide (CO_2) emissions from industrial or commercial facilities.

2) Requires ARB to establish a CCUS Program for developing the commercial application of CCUS to reduce CO_2 emissions from new and existing facilities.

3) Sets the objective of the CCUS program to be deploying CCUS projects that accelerate the development, deployment, and commercialization of advanced new CCUS technologies.

4) Requires all CCUS projects eligible for the program to:
   a) Be a public works project that pays prevailing wages; and
   b) Provide in the project application an enforceable commitment to ARB that all contractors and subcontractors will use a skilled and trained workforce for all works on the project that fall within an apprenticeable occupation in the building and construction trade or is covered by a project labor agreement that requires the use of a skilled and trained workforce.

Background

1) *GHG emission reduction targets*. The primary duties of ARB are to protect the public from the harmful effects of air pollution and develop programs and actions to fight climate change. ARB is tasked with the ambitious goal of achieving a 40% reduction of GHG emissions below 1990 levels by 2030 as set by SB 32 (2016). In order to meet this goal, California will need to reduce its GHG emissions by approximately 4% each year, but during the latest year emission data are available the state reduced its GHG emissions by only 1.6% (2021 California Green Innovation Index). In order to increase the rate of GHG emission reductions the state will need to dramatically decrease its

emissions. All four paths to make these reductions presented at ARB's March 15, 2022 Scoping Plan Initial Modeling Workshop rely on at least some amount of carbon capture and storage.

2) *Carbon capture and storage (CCS) technology.* CCS is a process of separating CO_2 from a point source, such as the flue of a gas-fired power plant or a cement plant, and putting it into long-term storage, usually by injecting CO_2 into a geological reservoir. CCS is generally considered by experts to be a CO_2 reduction strategy, not a CO_2 removal strategy, since it is only reducing CO_2 from anthropogenic sources that would have otherwise entered the atmosphere, rather than removing what was already there. Nevertheless, if properly developed CCS has the potential to reduce emissions by millions of tons every year.

   CCS is adoptable in California due to the existing geological storage from the state's history of fossil fuel extraction. However, according to a Lawrence Livermore National Laboratory report published in 2021, no CCS projects exist today in California, and it is unlikely that CCS could be scaled up at the pace needed due to the current regulatory framework for screening and authorizing projects. ARB has already adopted a CCS protocol under the Low Carbon Fuel Standard (LCFS), including for out-of-state CCS projects, to help incentivize the adoption of CCS technology.

3) *Utilization of captured carbon.* Once CO_2 has been captured from a point source instead of being sequestered geologically it can also be utilized for industrial purposes. One of the most common applications is in Enhanced Oil Recovery (EOR), where the highly pressurized captured CO_2 is injected into oil wells that have already been tapped in order to draw even more oil from the wells. Once injected the CO_2 is effectively permanently sequestered and will likely not leak – barring seismic events or accidents as have occasionally occurred at existing facilities such as in 1975 in Denver City, in 2011 in Weyburn, and in 2016 in Wyoming. California has extensive permitting and review requirements for CCS projects to ensure such events do not occur. During the injection process much of the initially captured CO_2 is lost as the oil is collected from the well. So, while EOR using CO_2 does result in fewer emissions than EOR using CO_2 sourced from buried wells (the most common practice), it does result in more emission of the captured CO_2 than if the CO_2 was just sequestered. Research suggests emissions get worse over time, shifting the EOR process from being net negative emission to net positive emissions after 10-20 years of use.

Captured CO_2 can also be utilized in industrial processes where it is used to produce more valuable materials. CO_2 can be incorporated into building materials by converting it into carbonate, though this requires a source of calcium or magnesium and is not currently viable at industrial scale, or by incorporating it directly during cement production. CO_2 can be used to produce plastics or other useful chemical compounds, though this requires incorporation of hydrogen which generally requires energy input, making the process only as carbon neutral as the energy source. CO_2 can be used to generate biofuels, though when those fuels are later used the CO_2 will be released, negating the purpose of the initial capture. All of these techniques are not widely deployed because they generally are not cost-effective and require further technology development.

4) *Carbon capture is not a new idea*. According to the 2021 Global CCS Institute (GCCSI) Global Status of CCS Report, the earliest example of carbon capture technology being used was in 1972 in Texas at a natural gas processing plant where it supplied CO_2 to a nearby oilfield for EOR. After decades of development and investment, there are 27 commercial-scale carbon capture projects operating worldwide today, capturing a total of 36.6 million tons of carbon per year, an amount equivalent to nearly 9% of California's annual emissions. The majority of global CCS capacity operating today was built prior to 2011, and captures carbon from natural gas processing plants.

   In 2010, the California Carbon Capture and Storage Review Panel (formed by the California Public Utilities Commission, CEC, and ARB and composed of experts from industry, trade groups, academia, and environmental organizations) issued findings and recommendations for how to deploy CCS at a greater scale in California. Those findings and recommendations were based in part on deliberations made at the sixteenth session of the Conference of the Parties (COP 16) and the issuance of federal subsurface CO_2 injection regulations, both of which happened in 2010. Some of the key findings from that 2010 report included, "Technology currently exists for the safe and effective capture, transport, and geological storage of CO_2 from power plants and other large industrial facilities…There is a need for clear, efficient, and consistent regulatory requirements and authority for permitting all phases of CCS projects in California, including CO_2 capture, transport, and storage."

   Despite these calls for more CCS, development and deployment of CCS technology has been slow. Between 2010 and 2017 the number of facilities across the globe that actively invested in CCS technology declined from 77 to 37. Most demonstration projects have failed to transition into fully operating plants in part due to fluctuating markets and insufficient financial support.

Several of the most recent projects have also suffered from failures in achieving promised sequestration goals, such as the Gorgon facility in Western Australia, which only stored 5.5 million metric tons of CO_2 over 3 years of a promised 12 million, or the Petra Nova facility in Texas which, before its closure in 2020, missed its sequestration targets by 17%.

5) *Permitting CCS in California*. A recent report from Lawrence Livermore National Laboratory posits that California's permitting requirements take 5-6 years to complete. Given California's fast-approaching climate deadlines, slow CCS permitting could cause it to be unusable for meeting those goals. The report cites a lengthy environmental review process, a lack of jurisdictional clarity, cross-agency input at local, state and federal levels, and an absence of a joint-review process as key determinants of the lengthy timeline.

Comments

1) *Purpose of Bill.* According to the author, "Climate change in California has increased in severity and poses a significant threat to public health, safety, and the economy. California has led the world in addressing and reducing greenhouse gas (GHGs) emissions through its numerous programs that support the goal of cutting GHG emissions to below 1990 levels by 2030, as well as the goal to achieve net carbon neutrality by 2045 in order to achieve global climate stabilization.

"The state must deploy a range of cost effective and technologically feasible programs and tools to meet the goals in a way that minimizes the economic impact on Californians. Numerous experts agree that Carbon Capture Utilization and Sequestration (CCUS) is vital to California's plans of carbon neutrality by 2045 due to the CO_2 emissions captured and stored from commercial facilities, upwards of 90% of total carbon emissions, when these types of projects are employed. There are several other benefits to expanding upon carbon capture projects as well, including providing jobs for Californians with skillsets that may begin to lack demand in the transition to clean energy technologies. SB 1101 is a small but significant part of the equation for goals related to expanding carbon capture opportunities in our state. SB 1101 will enable the development and use of CCUS by creating an administrative framework at the CA Air Resources Board that provides support for carbon capture projects seeking approval across the state. Additionally, this bill will establish a clear legal framework for pore space ownership, which is critical to support successful deployment of carbon capture, utilization and sequestration in California."

2) *Carbon capture can serve as a bridge to new technologies– or a tether to old ones.* There are industries in which eliminating the majority of GHG emissions is not viable. The chemical reactions that generate important products such as cement, steel, glass, aluminum, and ethanol all create CO_2 as byproduct. These emissions cannot be avoided and so in these sectors some form of CCS will likely be an important component in achieving net zero emissions. Furthermore, many industrial-scale chemical and manufacturing reactions require extremely high temperatures which currently can only be practically obtained through the combustion of fossil fuels. In the future, the need for this may be abated somewhat by electric furnaces, "green" hydrogen, or other technological advances, but within the time-frame of California's emission reduction goals these solutions are not widely implementable. CCS could buy time for these industries to develop new technologies and mitigate the remaining emissions that cannot be abated.

   However, CCUS has instead been primarily used in sectors where there are other options to reduce emissions: energy production and the production of fossil fuels. CCUS for energy production has been effective at reducing emissions at the point of energy generation in several facilities by as much as 90%. When using captured carbon for EOR it takes more captured CO_2 to recover one barrel's worth of oil than would be generated by the combustion of that barrel of oil, making it "carbon-negative". Unfortunately, these assessments only hold up in a very specific frame of analysis. The total emissions from fossil fuels occur at multiple points along their lifecycle including at the CCS step when energy is needed to capture the CO_2. This energy often comes from the combustion of fossil fuels, increasing the overall emissions of the process. When all emissions are taken into account, research has estimated the use of CCS has only been able to capture approximately 10% of emissions at coal facilities. That same research estimates that when accounting for the health, equipment, and climate costs, combusting coal and using CCS powered by natural gas is approximately 20% higher than simple coal combustion because of the extra pollutants created by the natural gas combustion.

   Implementing CCS for fossil fuel production or EOR cuts into the emissions savings from CCS and perpetuates economic and infrastructure reliance on fossil fuels as an energy source. Furthermore, CCS technologies on their own do nothing to reduce the criteria pollutants emitted from these facilities, continuing the health burden they place on nearby (usually disadvantaged) communities. The best way to mitigate the emissions from these industries is to replace them with no GHG-emission energy production wherever possible.

Given the diversity of possible projects supported by the program established in the bill, the committee may wish to amend the bill to direct ARB to weigh specific priorities when evaluating applicant projects: maximizing emission reductions, minimizing environmental impacts from construction, promoting environmental justice goals, providing benefits to disadvantaged communities, leveraging private funding sources, and reducing fossil fuel production within the state.

3) *CO_2 pipeline leaks can have dangerous consequences for nearby communities.* This bill declares it the intent of the Legislature to establish a policy framework for the investment in pipelines to carry CO_2, which will be necessary for any carbon sequestration or utilization projects not occurring directly at the site of capture. While accidents are rare and California's permitting guidelines promote safe construction, events like the 2020 CO_2 pipeline leak in Sataria, Mississippi demonstrate that the placement of CO_2 pipelines can put communities at risk. ***In order to address concerns about safety, the committee may wish to amend the intent of the bill to clarify that the Legislature intends to develop a permitting process to invest in pipelines for the safe transport of CO_2 that will minimize risks to communities.***

4) *Liability and pore ownership.* This bill addresses one of the problems slowing down CCUS implementation: pore ownership. Pore ownership and resulting concerns about liability fall under the purview of the Natural Resources and Water Committee and Judiciary committee. As the bill moves through the process, the author should work with those committees to ensure the definition in the bill eases implementation of CCUS without incorrectly assigning liability to the state for work done by contractors.

5) *Committee amendments.* ***Staff recommends the committee adopt the bolded amendments contained in comments 2 and 3 above. Due to timing constraints, should the committee approve this bill, the amendments will be adopted by the Senate Natural Resources and Water Committee.***

Related/Prior Legislation

SB 905 (Skinner, 2022) tasks ARB with developing and administering the Geologic Carbon Sequestration Demonstration Initiative to fund 1-3 geologic CCS projects at cement production facilities. It was heard in the Senate Environmental Quality Committee on March 28, 2022 and was passed out of committee on a vote of 5-2 and referred to the Senate Education Committee.

SB 1399 (Wieckowski, 2022) tasks the CEC with establishing a pilot program to fund three CCS projects at existing industrial facilities, natural gas electric generation facilities, and biomass electric generation facilities. The bill has been scheduled to be heard in the Senate Energy, Utilities, and Communications Committee on April 18, 2022.

SB 1314 (Limón, 2022) prohibits the use of carbon captured in CCUS projects to be injected into wells for the purposes of EOR. The bill has been scheduled to be heard in the Senate Natural Resources and Water Committee on April 26, 2022.

SB 1314 (Limón, 2022) prohibits an operator from injecting CO_2 produced from a CCS project into a Class II injection well for the purposes of EOR. The bill has been referred to the Senate Committee of Natural Resources and Water.

AB-2944 (Petrie-Norris, 2022) would require ARB to include in an annual report to the Joint Legislative Budget Committee, an evaluation of how CCUS technologies are contributing to the state's efforts to reduce GHG emissions. The bill has been referred to the Assembly Committee on Natural Resources.

SB 34 (Calderon, 2012) would have required ARB to regulate the injection of CO_2 at an EOR project seeking to demonstrate CCS capabilities. The bill was held in the Senate Appropriations Committee.

DOUBLE REFERRAL:

If this measure is approved by the Senate Environmental Quality Committee, the do pass motion must include the action to re-refer the bill to the Senate Natural Resources and Water Committee.

SOURCE: State Building and Construction Trades Council of California

SUPPORT:

California Association of Professional Scientists
California Carbon Capture Coalition
Clean Air Task Force
Independent Energy Producers Association
Western States Petroleum Association

OPPOSITION:

California Environmental Voters (formerly Clcv)

ARGUMENTS IN SUPPORT: According to the California Carbon Capture Coalition, "CCUS technologies have been safely and successfully practiced for decades across the spectrum of capture, transport and storage activities. These technologies and practices can be applied, refined, and enhanced to enable CCUS to play a meaningful role in California's decarbonization efforts. California industries possess a depth of technological capability and technical expertise to quickly and safely deploy CCUS. The state has one of most skilled workforces in the world standing at the ready to design, build and operate CCUS projects and infrastructure.

"Deployment of carbon capture, utilization and sequestration technology affords California a significant opportunity to create and preserve hundreds of thousands of high quality, high wage jobs across the state in both new and existing industries. Bringing CCUS projects and infrastructure on-line in California will support a range of employment opportunities across multiple economic sectors including construction and pre-construction, engineering, sciences, project development and ongoing project management. CCUS technologies in California will also play a key role in helping to manage the costs associated with California's efforts to decarbonize, including by providing billions of dollars in energy savings for Californians.

"By establishing a comprehensive program to support the timely development, deployment and commercialization of CCUS technologies across a range of industries and economic sectors, SB 1101 will enable California to take full advantage of the significant climate, economic and job creation benefits that CCUS can deliver. SB 1101 would also ensure that California has a clear legal framework for pore space ownership, which is critical to enable the state to safely, efficiently and permanently store captured greenhouse gas emissions deep underground."

ARGUMENTS IN OPPOSITION: According to California Environmental Voters, "Despite decades of research and development and billions of federal dollars invested to scale up this technology, CCS used on fossil fuel infrastructure has proven to not be a cost-effective investment and fails to deliver on the promised emissions reductions in almost every case. Instead, CCS has simply extended the life of fossil fuel plants. The US has been subsidizing and commercializing CCS technology on fossil fuel plants since the early 2000's. Of the 39 projects nationwide that scientists examined, roughly 80% failed to deliver the benefits promised at the cost projected (of those 39, all 14 of the largest and most ambitious CCS projects undertaken were abandoned citing costs far over budget and feasibility concerns.) Moreover, this study found that the projects with

the most public investment were the most likely to fail, because the scale and scope of those projects was simply far beyond what developers promised in terms of costs and promised emissions reductions…

"Since the majority of captured carbon currently is used for enhanced oil recovery, the state needs certainty that captured carbon will not be used for enhanced oil recovery, by prohibiting the use of captured carbon for enhanced oil recovery. The use of captured carbon for enhanced oil recovery is not and should never be considered a permanent storage of the CO2 due to the added emissions of increased oil production and the eventual burning of fossil fuels…

"Public dollars are far better spent on clean energy solutions that accelerate the transition away from our dependence on fossil fuels and which have significantly greater capacity to reduce greenhouse gas emissions and toxic air pollutants. The State Legislature should be extremely cautious in any consideration to subsidize the commercialization of captured carbon. The use of carbon capture and storage technology must not result in a net increase in local toxic air pollution, must not be ultimately used for enhanced oil recovery, and any industries receiving subsidies or credit for capturing carbon must be required to implement direct emissions measures before considering the use of carbon capture and storage technologies or receiving any incentive, subsidy, or credit from the state."

-- END --