



February 20, 2024

California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Proposed 2024 Low Carbon Fuel Standard Amendments

Dear Chair Liane Randolph,

On behalf of 1PointFive, I extend our gratitude for the opportunity to provide comments on the California Air Resources Board's (CARB) 2024 Proposed Amendments to the Low Carbon Fuel Standard (LCFS). 1PointFive is a Carbon Capture, Utilization and Sequestration company that is working to help curb global temperature rise to 1.5°C by 2050 through the deployment of decarbonization solutions, including Carbon Engineering's Direct Air Capture (DAC) and AIR TO FUELS™ solutions alongside geologic sequestration hubs.

We commend the state's unwavering commitment to climate action and leadership in incentivizing the deployment of carbon capture and sequestration (CCS) and DAC technologies. As a pioneer in sustainable practices, California has demonstrated the feasibility and efficacy of ambitious low carbon fuel standards, significantly influencing other jurisdictions in shaping their climate policies. California's leadership continues to catalyze a broader, collective commitment to fostering cleaner, more sustainable energy practices on a global scale.

California's dedication to reducing greenhouse gas (GHG) emissions sets a laudable example, and we appreciate the chance to contribute to the ongoing dialogue. Our comments are focused on the proposed amendments related to DAC and CCS. As identified by California's Scoping Plan, these technologies play a critical role in achieving the state's climate goals. We look forward to engaging in a constructive discussion to further enhance California's LCFS regulation.

Indirect Accounting of Low-CI Electricity in Direct Air Capture Projects

1PointFive strongly supports CARB's proposal to permit indirect accounting for low-CI electricity, biomethane and low-CI hydrogen.¹ Pursuant to CARB's proposed LCFS amendments, reporting entities may use indirect accounting mechanisms for low-CI electricity supplied as a transportation fuel, for hydrogen used as a transportation fuel, or *for direct air capture projects*, provided certain conditions are met. In conjunction with the amendment providing for indirect accounting for DAC, we also support CARB's proposed definition for "Book-and-Claim Accounting".²

1PointFive is currently constructing the first commercial scale DAC project which, once complete, will have a design capacity to capture 500,000 tons of CO₂ per year from the atmosphere. To maximize net removal of CO₂, DAC technologies require a continuous, reliable, and economic electricity supply. CARB's proposed amendments including indirect accounting methods for DAC, i.e., book-and-claim, are critical to ensuring the technical and commercial

¹ Proposed Amendments to the Low Carbon Fuel Standard Regulation, 17 CCR §95488.8(i)(1) ("Book-and-Claim Accounting for Low-CI Electricity Supplied as a Fuel, Direct Air Capture projects, or Used to Produce Hydrogen as a transportation fuel").

² Defined as "an indirect accounting system where a physical product and its environmental attributes can be separately traded...separated environmental attributes of low-CI electricity...may be matched under certain conditions to the use of grid electricity...." Proposed Amendments to the Low Carbon Fuel Standard Regulation, 17 CCR §95488.

feasibility of this nascent technology. And, as CARB noted in its Initial Statement of Reasons (ISOR), DAC is a key scoping plan component to meeting California's 2045 carbon neutrality goals.³

1PointFive's position is that book-and-claim accounting will also be a key contributor to the broader deployment of DAC at a climate-relevant scale. While small pilot-scale DAC projects may be able to rely upon "behind the meter" connections to provide needed energy, larger commercial-scale projects need multiple commercial-scale energy sources to ensure a continuous supply of energy. CARB's inclusion of book-and-claim accounting recognizes the challenges of optimally siting renewable and low-CI electricity projects, enables projects to enter into commercially competitive power purchase agreements with multiple energy sources, and serves as a powerful incentive for the development of new and expanded renewable and low-CI energy electricity generation.

Risk of Resource Shuffling and CARB's Proposed Criterion in 95488.8(i)(1)(C):

1PointFive is cognizant that any use of indirect or book-and-claim accounting must avoid creating or elevating the risk of "resource shuffling." To address this risk, CARB proposes that in order for reporting entities to use indirect accounting mechanisms for low-CI electricity supplied as a transportation fuel, for hydrogen used as a transportation fuel, or for direct air capture projects, five requirements or criterion must be met.⁴ CARB explains that "[t]hese requirements will help ensure against resource shuffling where existing renewable electricity is potentially redirected to hydrogen production and backfilled with non-zero electricity."⁵ Although not expressed in the ISOR, we understand that this reasoning applies equally to hydrogen and DAC.

1PointFive supports including amendments to the LCFS that will mitigate the risk of resource shuffling but recommends revisions to reflect the technical feasibility and commercial implications of imposing these criteria on DAC projects. **As part of its DAC development program, 1PointFive has carefully examined low-CI electricity sourcing and has determined that a book-and-claim accounting period shorter than 12 months is currently infeasible and will severely constrain the deployment of this important climate mitigation technology.** Such a requirement should wait until such time when robust long-duration storage capacity is available, the necessary market and regulatory frameworks are in place, and sufficient dispatchable low-CI electricity is available, which we anticipate will not occur in this decade. Otherwise, the outcome of including this constraint would be harmful to the imperative to facilitate successive and rapid deployment of the initial generations of DAC technologies to progress along the technology learning curve and reduce costs to enable future deployment at a scale meaningful for climate mitigation.

CARB Should Require Low-CI Electricity to be Supplied to the Grid Within the Local Balancing Authority Where the DAC is Located

1PointFive supports CARB's recommendation that the low-CI electricity must be supplied to the grid within the local balancing authority where the DAC project is consuming the electricity. Furthermore, 1PointFive proposes that if the new low-CI electricity source from which the DAC

³ California Air Resources Board, Staff Report: Initial Statement of Reasons. 32, 80, 124. Dec. 19, 2023; California Air Resources Board, 2022 Scoping Plan for Achieving Carbon Neutrality. 91-97. Nov. 16, 2022 ("increased deployment of DAC can help achieve net negative emissions...help[ing] avoid the most damaging impacts of climate change.").

⁴ See, § 95488.8(i)(1)(C).

⁵ California Air Resources Board, Staff Report: Initial Statement of Reasons. 34. Dec. 19, 2023.

project procures its electricity is not located in the same balancing authority as the DAC project, the DAC project must demonstrate that it can contractually and physically be able to supply the electricity to the grid within the local balancing authority where the DAC project is located. This will help mitigate the risk of resource shuffling or the double-counting of benefits.

CARB has already found that this approach, combined with the requirement that low-CI electricity be new or expanded (as required by criterion 3) did not lead to resource shuffling in the cap-and-trade program. The cap-and-trade program and the LCFS are two of the four credit trading programs California implements. Although the program frameworks differ in some respects, there are several similarities. Each establishes a declining target (for cap-and-trade, the total amount of permissible emissions, calculated on an annual basis, for LCFS, a carbon intensity applicable to transportation fuels that may be calculated on an annual or quarterly basis) and each allows for the creation and trading of credits (referred to as allowances under cap-and-trade) to meet annual compliance obligations.

The cap-and-trade program regulations expressly prohibit resource shuffling and in its analysis of the potential for resource shuffling within the cap-and-trade program, CARB found that California and Western Electricity Coordinating Council (WECC)-wide GHG emissions from electricity production decreased after 2013.⁶ CARB analysis concludes that these decreases in emissions and the corresponding increases in zero-GHG and natural gas generation are key indicators the California Cap-and-Trade Program has not resulted in resource shuffling. Further, CARB found that declining costs of natural gas and renewable generation were driving year-over-year decreases in California electricity GHG emissions from both imports and in-State generation as in-State renewables more than doubled since 2013 and renewable generation in the WECC increased year over-year. We are confident that this analysis applies equally for the LCFS and should be used to inform CARB's consideration of the LCFS's approach to permitting annual balancing for DAC projects. We also encourage CARB to periodically update its review of the potential for resource shuffling for both the cap-and-trade and LCFS programs.

CARB Should Focus on Ensuring that the Low-CI Power can be Accurately Tracked Rather than the First Contracting Entity

1PointFive supports CARB's efforts to ensure that the low-CI electricity and associated environmental attributes are accurately tracked and accounted to mitigate the risk of double counting renewable energy certificate (RECs) or other environmental attributes. We understand that CARB's proposal that "The pathway holder must be the first contracted entity for procuring the low-CI power" is designed to mitigate this risk. However, 1PointFive recommends that rather than requiring DAC projects to be the first contracted entity, CARB should focus on requiring the pathway holder or project operator to prove that it can and has tracked the RECs and, in accordance with CARB's proposed amendments, that credits are retired and not claimed under any other program, other than those expressly listed.⁷

In addition, CARB's proposed requirement is inconsistent with certain practical commercial approaches taken by companies to execute and manage power procurement contracts. In many cases, parent companies will establish an affiliate to manage their power purchase agreements, track, account and retire RECs and ensure electricity usage is managed on a daily basis across multiple decarbonization projects or business units. 1PointFive understands that CARB may be intending to prevent the double-counting of low-CI power procured and, if so, we recommend

⁶ California Air Resources Board, Review of Potential for Resource Shuffling in the Electricity Sector. Feb. 2020.

⁷ Proposed Amendments to the Low Carbon Fuel Standard Regulation, 17 CCR 95488.8(i)(5)(C)5.

that the criteria be changed to require the pathway holder (not necessarily the contracting entity) to be the only entity that can claim the electricity and associated environmental attributes from the low-CI project, and such claim must be auditable and verifiable by CARB. In the alternative, CARB could revise this criterion to recognize commercial realities as follows:

“The pathway holder, ~~or the project operator~~ or any of its affiliates must be the first contracted entity for procuring the low-CI electricity.”

CARB Should Confirm that New or Expanded Low-CI Electricity Includes Repowered Sources

1PointFive fully supports the requirement that any low-CI electricity must be supplied by new or expanded low-CI electricity that begins new or expanded production on or after January 1, 2022, or within three years of the start of the DAC project. This is the key requirement to achieve CARB’s goal to prevent resource shuffling. However, 1PointFive respectfully requests that CARB confirms that a full repower of a renewable resource will qualify as a new low-CI source so long as it meets the criteria established by the Internal Revenue Service’s “80/20” rule.⁸

CARB Should Permit Indirect Accounting on an Annual Basis

Requiring book and claim accounting to span a single quarter is neither technically feasible nor commercially viable. For direct air capture projects, we recommend that CARB revise its proposed amendments to permit book and claim accounting for low-CI electricity on no less than an annual basis.

Allowing low-CI electricity matching to span a minimum of four quarters is necessary for a number of reasons. First, solar and wind energy capacity is subject to significant seasonal variability, regardless of the geographic location of the solar or wind energy generation. In the case of solar energy generation, seasonal variation is well documented across the United States and becomes more pronounced as latitudes increase. Consequently, any new and additional solar energy sources will provide significantly more electricity than a DAC project will need during summer months, particularly during the later days of a second calendar quarter and early days of a third calendar quarter but significantly less than a DAC project will need during the fourth and first calendar quarters. Seasonal variabilities in wind energy capacity are also well documented, although more dependent on geographic location. While seasonal variation in wind capacity is more localized, it is particularly pronounced on the west coast. Consequently, renewable power capacity, regardless of location, experiences significant seasonal variations, independent of and across multiple calendar quarters. Therefore, the use of book-and-claim accounting must be allowed to span at least four quarters to encompass a full seasonal cycle.

Some may suggest that renewable power generation combined with battery storage can address variabilities in the available renewable energy capacity. This is currently not a technically feasible or viable solution. Generally, large scale battery storage capacity is currently limited to less than four hours and suffers from pronounced energy degradation.⁹ Battery storage can be configured for longer durations but not such durations sufficient to support a quarterly balancing period. Long duration energy storage (LDES) beyond 4 hours is a

⁸ Definition of Energy Property and Rules Applicable to the Energy Credit, 88 Fed. Reg. 82188, 82211, 82218 (Nov. 22, 2023).

⁹ Denholm, Paul, Wesley Cole, and Nate Blair. 2023. Moving Beyond 4-Hour Li-Ion Batteries: Challenges and Opportunities for Long(er)-Duration Energy Storage. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A40-85878. <https://www.nrel.gov/docs/fy23osti/85878.pdf>.

recognized challenge. The challenge is perhaps most clearly exemplified by the Department of Energy's (DOE) "Long Duration Storage Energy Earthshot" announced in 2022 that establishes a target to reduce the cost of grid-scale energy storage by 90% for systems that deliver 10+ hours of duration within the decade. In September 2023, the DOE's Office of Clean Energy Demonstrations announced funding of \$325 million for nine proposals for LDES test projects. While these first projects (which have been selected but are yet to be awarded) appear promising, they also provide a clear indication that broader deployment of LDES, on both a technical and economic basis, is unlikely before 2035. DAC deployment cannot wait on these technologies to reach suitable duration, cost and deployment.

Resource Shuffling is not Dependent on Whether the Use of Low-CI Electricity Spans Multiple Quarters

We understand that CARB proposes a quarterly balancing period as a mitigating factor against resource shuffling. As CARB explains in its ISOR:

"[L]ow CI electricity must be new or expanded capacity, must be delivered to the local balancing authority... and must be matched on a quarterly basis. These requirements will help ensure against resource shuffling where existing renewable electricity is potentially redirected... and backfilled with non-zero electricity."¹⁰

We agree that requiring new or expanded capacity low-CI electricity and delivery to the local balancing authority will help ensure against resource shuffling. However, as we discuss, *supra*,¹¹ we urge CARB to permit the use of low-CI electricity to span multiple quarters because we are confident that it will have no effect on, much less enable, resource shuffling. DAC projects seeking to maximize net CO₂ capture and sequestration will necessarily enter power purchase agreements with low-CI electricity suppliers. CARB's requirement that these sources be new or expanded will result in additional low-CI sources being developed and brought on-line to primarily provide energy to DAC projects, with excess energy provided to the grid. Delivery to the local balancing authority will help ensure that additional low-CI electricity projects will not permit high-CI energy to be sent to other balancing authorities. The additional criteria that RECs and other environmental attributes associated with the electricity are not issued credits or claimed produced or are retired and not claimed (except as permitted by the proposed amendment language) will require DAC projects to establish robust tracking, accounting and verification processes that meet or exceed CARB requirements. If these criteria are met, we are aware of no analysis suggesting that permitting the use of low-CI to span multiple quarters will somehow lead to resource shuffling.

There is no Correlation Between Calendar Quarters and Renewable Electricity Generation

The use of at least an annual balancing period should also be permitted because there is simply no correlation between calendar quarters and renewable electricity generation. In addition, to seasonal and year-over-year variations, renewable electricity generation varies significantly within quarters. This is not surprising because the calendar quarters in the United States do not align with seasonal electricity generation. The seasonal and year-over-year variability of renewable electricity generation is effectively illustrated by the California Energy Commission's (CEC) Visualization of Seasonal Variation in California Wind Generation website.¹² Users

¹⁰ California Air Resources Board, Staff Report: Initial Statement of Reasons. 34. Dec. 19, 2023.

¹¹ CARB, Review of Potential for Resource Shuffling in the Electricity Sector.

¹² <https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/visualization-seasonal-variation-0>, last accessed February 17, 2024.

accessing the CEC's website can enter the month and year and generate a graphical representation of wind energy production. The resultant graphs clearly show that wind energy generation varies significantly even within calendar quarters.

Global Deployment of Direct Air Capture is Critical for Achieving Cost Reductions and Climate Goals

California's leadership in addressing climate change is evident through its innovative approach to incentivizing DAC technology. By incorporating DAC into its LCFS regulation and allowing projects to be located anywhere in the world, California recognizes the shared nature of the atmosphere and the collective benefit of CO₂ emissions reduction and removal wherever it occurs on Earth. DAC technology has an important role in climate mitigation, but its widespread deployment is contingent upon achieving cost reductions through repeated deployment as rapidly as possible. California's precedent to allow for global deployment of DAC in its LCFS market helps facilitate accelerated deployment by enabling DAC projects to be located where they can be most effective and economical. Each DAC technology is most efficient in certain climatic conditions and requires access to low-CI power and secure geologic sequestration resources, which every jurisdiction cannot offer equally. DAC deployment at climate-relevant scale will therefore be greatly facilitated by market systems that enable deployment in the geographical regions they are best suited to.

As noted in its ISOR, CARB's LCFS program influences the development of similar programs in other jurisdictions, including Japan, the European Union, and Australia, with this list likely to grow in the future. Limiting DAC's geographic deployment to the United States, as proposed in § 95490(a)(2)(A), may encourage other jurisdictions to adopt similar deployment restrictions. Such restrictions will reduce the markets each DAC facility can access, making financing and deployment more difficult, and therefore hinder the ability to achieve rapid cost reductions to enable large-scale deployment. Global cooperation in emissions reductions and removals trading will be essential for optimizing the path to net-zero emissions. We encourage CARB to continue to allow for globally deployed DAC projects to generate LCFS credits.

Jointly Filed Application for CCS Credits

1Pointfive appreciates CARB's initiative to track the movement of CO₂ throughout the supply chain, from point of capture to secure storage. However, adding the entity responsible for transporting captured CO₂, as proposed by § 95490(c)(1), may obstruct development of CCS projects because parties providing transport, are reluctant if not entirely opposed to taking on the responsibility of understanding subsurface geology and geophysics. Further, there is simply no reason for such parties to take on such tasks because carbon capture and sequestration projects may only generate LCFS credits once the CO₂ is stored in a CCS Project that has met the requirements of the CCS Protocol. In the unlikely event that captured CO₂ is lost by the party owning or operating the transportation infrastructure, those lost masses of CO₂ will never be included in a calculation of CO₂ for purposes of generating credits because the CO₂ never reaches the sequestration site. Accordingly, the responsibility for understanding subsurface geology and geophysics and the other requirements of the U.S. Environmental Protection Agency's Underground Injection Control Class VI regulation and the CCS Protocol are best imposed on the sequestration site owner/operator (even if there is a contractual allocation of risk, this is a matter between the parties in privity with the sequestration site operator).

However, we do recognize that where parties agree to submit a fuel pathway that maximizes LCFS credit generation through the use of a CARB approved sequestration project, it is

appropriate that the fuel pathway be a joint application to ensure that the fuel pathway, which will receive the generated LCFS credits, can be held responsible for any credit invalidation.

Crediting Period for Carbon Capture and Sequestration Projects

California's Scoping Plan underscores the importance of point source carbon capture technologies, particularly in industries such as petroleum refining, cement production, and electricity generation from gas plants, to achieve its long-term climate target. 1PointFive supports CARB's proposed amendment to allow the crediting period for CCS projects in the Refinery Investment Credit Program to extend beyond 2040 as proposed in § 95489(e)(5)(B). This proposal acknowledges the critical role of CCS in helping California achieve its ambitious climate goals and will enable ongoing investment and innovation in CCS technology, ensuring its long-term viability as a climate mitigation solution.

Conclusion

In closing, we fully support CARB's proposal to allow indirect accounting for low-CI electricity used by DAC projects. However, we believe there are significant challenges to requiring that low-CI electricity use by DAC span a single calendar quarter, including.

- **Technological:** As discussed, *supra*, pairing seasonal and intermittent low-carbon electricity generation (e.g., renewables) with long term energy storage technology is simply not achievable today at the scale needed to support DAC projects currently being deployed. Existing battery energy storage systems that have been deployed in the US generally have less than a 4 hours duration, and only represent a small portion of the available capacity of the grids where they are installed, making it infeasible to firm-up intermittent resources for sustainable periods. Furthermore, in order to maximize the amount of carbon sequestered, DAC technologies should not be cycled in response to the seasonality of renewable resources, and instead should operate at maximum capacity year-round. Annual matching, in conjunction with the additionality requirements, accomplishes CARB's goal of ensuring that enough new low-CI generation is installed in the grid where the project will operate, while allowing DACs to operate at full capacity year-round without the burden of having to over-build or over-procure.
- **Logistics:** The tracking, trading, and usage systems supporting energy attributes (e.g., RECs) currently only allow for annual time resolution; systems capable of handling shorter time resolution are projected to take years to put into place (with a few very limited exceptions like PJM and M-RETS). Moreover, the mere availability of tracking systems to handle shorter time resolution is not sufficient; robust liquid markets for shorter time resolution energy attributes will be needed to achieve acceptable supply and pricing risk for project finance. These markets will take years to develop. In the interim, there is no ability for a project to be able to cover this risk other than significantly over contracting/installing low-carbon intensity generation, putting undue financial stress on projects.
- **Economics:** The additional economic burden required to comply with the first two challenges is significant and risks stifling this nascent industry. We are concerned about the increased low-carbon power supplies required to cover for intermittent generation under a balancing period of one quarter. For example, we have estimated that on a quarterly reconciliation basis an additional 25% more power could be required to be over-contracted and not consumed by the DAC project, at substantial market price risk,

compared with annual matching even in the most favorable locations for renewable resources.

Given the current technological, market systems, and economic landscape for continuous low-CI electricity supply, annual book-and-claim matching period is necessary and appropriate for DAC technology today. Annual matching, in conjunction with the additionality requirements, accomplishes CARB's goal of ensuring that enough new low-CI generation is installed in the grid where the project will operate to prevent resource shuffling, while allowing DAC projects to operate at full capacity year-round without the additional cost and risks associated with quarterly matching. Requiring additional low-CI energy production in the local balancing authority is the key to avoiding resource shuffling and not balancing periods shorter than 12 months.

We would like to express our sincere appreciation for the opportunity to offer our insights on CARB's proposed LCFS amendments. We value the dialogue surrounding these significant matters and look forward to further discussions. Should any inquiries arise, we are prepared to provide thorough responses. We look forward to continuing our collaboration and working together to deploy CCS and DAC technologies.

Sincerely,

A handwritten signature in black ink that reads "Michael Avery". The signature is written in a cursive, flowing style.

Michael Avery
President and General Manager
1PointFive