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The Honorable Mary Nichols  
Chairman  
California Environmental Protection Agency  
Air Resources Board  
1001 I Street  
Sacramento, CA 95812

**RE: Cap-and-trade Proposed Regulations**

Dear Chairman Nichols and Members of the Board:

These comments are offered on behalf of Codexis, Inc. ("Codexis"). Codexis appreciates the opportunity to submit comments on the Air Resources Board's ("CARB") Proposed Regulation to Implement the California Cap and Trade Program ("Proposed Regulation").

Codexis, headquartered in Redwood City, is a leading provider of optimized biocatalysts that make existing industrial processes faster, cleaner and more efficient than current methods. Our products make new industrial processes possible at the commercial scale. We operate in a range of industries, including pharmaceuticals, bioindustrial chemicals and fuels, and energy generation.

Codexis is developing an enzyme to serve as a biological catalyst that vastly improves the economics and efficiency of capturing carbon dioxide (CO<sub>2</sub>) at existing or new stationary emission sources. The Department of Energy (DOE) is funding Codexis' efforts to make carbon capture and sequestration (CCS) retrofits commercially viable through the ARPA-E program.<sup>1</sup> Codexis is also interacting with the National Energy Technology Laboratory (NETL) to advance new enzyme-based capture technologies for post-combustion applications. Our efforts are critical to deploying CCS to fossil fuel resources because the cost of separating CO<sub>2</sub> from flue gas dominates the overall cost of applying CCS. Codexis and its partners estimate that our technology could lower the cost of carbon capture retrofits by one-third, primarily due to substantial reductions in capital costs, equipment size, and energy requirements, rendering the application of CCS far more economically and technically feasible to existing plants, allowing conventional resources to provide emission and energy security benefits.

Codexis strongly supports the CARB's cap-and-trade regulations as a mechanism to implement AB 32's direction to reduce greenhouse gas (GHG) emissions in California. We propose suggestions to help the cap-and-trade program meet AB 32's legislative objective to position California as a global economic and technological leader. We request that the program recognize the valuable role carbon capture technologies can play as part of the state's GHG reduction strategy, as well as the way CCS is contributing globally to climate solutions. By providing proper incentives for in-state clean technology development and deployment through policy drivers and strong regulatory signals, California will also promote in-state innovation and green job growth.

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<sup>1</sup> For more information, see ARPA-E, Codexis, Inc.: Low-Cost Biological Catalyst to Enable Efficient CO<sub>2</sub> Capture, available at <http://arpa-e.energy.gov/ProgramsProjects/IMPACCT/LowCostBiologicalCatalysttoEnableEfficientC.aspx>.

California's leadership in developing a comprehensive cap-and-trade program serves as a model for other states and national governments to reduce emissions, strengthen energy security, and drive the green economy. As such, the cap-and-trade program should encourage maximum emission reductions by incentivizing clean technologies that will deliver California and the world a low-carbon energy future, including through CCS. Specifically, we request that CARB:

- Incorporate CCS into the cap-and-trade program to provide adopters of CCS technologies credit for emission reductions;
- Exempt CCS-related emissions from a covered entity's compliance obligation;
- Lead globally by developing program to provide CCS with offset opportunities; and
- Apply auction revenues toward funding research and development into low carbon technologies, including CCS.

To this end, Codexis offers the following comments and recommendations:

### **The Proposed Regulation Should Encourage the Development and Deployment of Carbon Capture and Sequestration Technologies**

Given the extensive global investments in fossil fuel-powered generation, CCS is critical to address domestic and international GHG emissions from the electricity sector. CCS retrofits to existing facilities can greatly reduce emissions from this sector. California's landmark market-based cap-and-trade program should explicitly recognize CCS as a critical mechanism to meet the global challenge to reduce existing emissions.

While California has demonstrated significant leadership in encouraging the development of renewable resources through its Renewable Portfolio Standard Program and Low Carbon Fuel Standard, California's electricity sector remains dominated by fossil fuel powered baseload generation: approximately 16 percent of the state is powered by coal, and natural gas fuels approximately 50 percent of the state's electricity requirements.<sup>2</sup> CCS is the only technology demonstrated to capture emissions from existing emitters, not only from fossil fuel based generation, but also from the covered entities capped under the Proposed Regulation (i.e., the steel, cement, and refining industries).<sup>3</sup> California's position that CCS is required to reduce existing emissions is further evidenced by the recent RFP released by the California Energy Commission (CEC) to explore the retrofit of power plants within California in order to accommodate CCS.

Because fossil fuel based generation will continue to provide California a significant share of its electricity requirements, CARB's cap-and-trade program should encourage carbon capture retrofits to existing fossil fueled generation. As discussed, CCS can greatly reduce the emissions inherent in providing California its baseload generation, and can be applied to significantly reduce emissions from other industrial sources of GHGs.

We believe that the Final Regulation should provide developers of CCS technologies with credit for the significant carbon reductions that may be achieved through the use of carbon capture. We encourage CARB to develop methodology for measuring, reporting, and monetizing these emission reductions to incentivize power plants serving California's electricity load and industrial base to reduce existing emissions through CCS. The development of such a methodology will rapidly promote the research and development required to commercialize this technology. This would complement efforts of the CEC in providing leadership in the management of GHG emissions. Because of the significant contribution CCS can play in meeting the state's and the world's GHG goals, the CARB should develop a mechanism to recognize, account for, and verify CCS-related emission reductions.

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<sup>2</sup>See [http://www.energyalmanac.ca.gov/overview/energy\\_sources.html](http://www.energyalmanac.ca.gov/overview/energy_sources.html).

<sup>3</sup> McKinsey & Co. Report, 2008 "Carbon Capture and Storage: Assessing the Economics," available at: [http://www.mckinsey.com/client-service/ccsi/pdf/ccs\\_assessing\\_the\\_economics.pdf](http://www.mckinsey.com/client-service/ccsi/pdf/ccs_assessing_the_economics.pdf).

## **Emissions Connected with the CCS Process Should be Exempted from Covered Entity's Compliance Obligation**

Section 98852.2 of the Proposed Rule exempts certain emissions reported from source categories from counting toward a covered entity's compliance obligation in the cap-and-trade program, including emissions from renewable resources, hydrogen fuel cells, and certain process emissions from petroleum refineries and offshore oil platforms. Codexis encourages CARB to develop a methodology for reporting sequestered emissions in order to encourage the advancement of CCS.

Employing carbon capture requires extra energy to separate and capture CO<sub>2</sub>, compared to a plant that releases its emissions fully into the environment. Codexis technology aims to reduce this "energy penalty" inherent to CCS. Despite its inherent energy penalties, fitting CCS technology to high emitting facilities would make a significant contribution to reducing the GHG emissions required to power the state of California.

Exempting GHG emissions related to CCS may be accomplished by a number of means, including: CCS-related emissions should not count toward a covered entity's compliance obligation; the exemptions established at Section 95852.2 should be expanded to include captured and sequestered emissions; and/or emissions associated with separating and capturing carbon emissions should not count toward a covered entity's compliance obligation. We urge CARB to take action to assure that large emitters are motivated to invest in this promising technology.

## **GHG Reductions Occurring through CCS Should be Considered as Offsets**

The Proposed Rule requires offsets to meet criteria to determine that emission reductions are real, permanent, verifiable, and enforceable. Codexis agrees that offsets should be subject to a strong reporting protocol and compliance system to ensure environmental integrity. However, the Proposed Regulation does not allow offset development in the capped sector responsible for significant GHG emissions, and does not provide a mechanism to account properly for emission reductions attributed to CCS. To assist California's baseload generation to reduce its GHG emissions, CARB should utilize the offset program by developing offset-related opportunities for investments in CCS, for both the capped and uncapped sectors.

By developing a compliance offset protocol for CCS, California can take global leadership to shape policy requirements for global CCS offset projects. At the December 2010 conference of parties to the Kyoto Protocol, the United Nations (UN) approved CCS as a means to offset carbon under the Clean Development Mechanism provided issues related to permanence, boundaries and safety can be resolved. The approved resolution recognizes that CCS is a relevant technology for attaining the ultimate goal of the UN Framework Convention on Climate Change (UNFCCC) to reduce emissions, and requires rules for CCS projects to be finalized at the next conference of parties in December 2011. CARB should explicitly address these issues within the context of the cap-and-trade program and ancillary proceedings to develop a CCS offset protocol and coherent CCS policy in California, providing leadership to the global community.

California's offset protocol should encourage the development of CCS-related offset projects, both in California and globally. The availability of offset revenue for CCS-related projects will provide a significant signal that large emitters of carbon dioxide can recoup their investments in low-carbon technologies that can provide a reliable supply of electricity to California. Including CCS in the California offset regime will provide a clear regulatory signal to encourage the deployment of CCS technology.

We recommend that CARB develop a compliance grade CCS offset project protocol to promote the use of CCS technologies in both the capped and uncapped sectors. CARB should make available offsets for capped entities to provide additional support to recognize the significant investments required to deploy CCS

technologies, and the significant GHG reductions from which the state will benefit. Moreover, CARB's leadership in this area provides guidance to the global community as CCS is incorporated into the Kyoto Protocol's Clean Development Mechanism.

### **Auction Revenues Should Fund Investments in CCS Technologies**

For CCS to move rapidly toward commercial scale and contribute a measurable impact on emissions reductions, further incentives are required to encourage research and development and deployment of CCS technologies. We explicitly recommend that allowance auction revenues received by CARB and the California energy utilities be used in part to provide grants and other opportunities supporting investments in emerging clean technologies, including bio-industrial technologies that reduce GHG emissions and promote energy security.

By promoting technology under development by Codexis, California will enjoy increased energy independence and security by decreasing the amount of energy required for CCS, and providing economical GHG-abated electricity for advanced vehicle technologies. Cap-and-trade revenues should invest in California's low carbon energy future by accelerating research, development, and deployment of carbon capture and other innovative technologies required to meet the global challenge of emission reductions.

### **Actions by CARB Incentivizing CCS Will Create High Quality, California Based Jobs**

One of the key goals of AB 32 is to position California to be a global economic and technology leader in reducing GHG emissions. AB 32's economic goals are synergistic with the objectives of the American Recovery and Reinvestment Act- based funding from DOE's ARPA-E program, which has leveraged the creation of jobs for engineers, scientists, and equipment suppliers. Advancing Codexis' CCS technology has the ability to not only meet AB 32's goals of reducing GHGs, but also to create new, high quality jobs in California.

Using auction revenues to fund research and development will attract significant high quality job opportunities to California. The result of such efforts will provide the world with rich opportunities to learn from and import technologies developed and refined by Californians.

As California leads the nation in securing a low-carbon future, its investments in clean, transformational technologies will lessen emissions from the fossil-fuel baseload generation that continues to fuel California and the world. By providing policy and financial incentives for CCS through California's market based cap-and-trade program, California will be positioned to become a clean technology leader, and be in a strong position to capture the CCS market that is required to address the global challenge of reducing emissions from fossil fuel based generation. We urge CARB to adopt a cap-and-trade program that positions California companies to lead globally, and share its knowledge and best practices for low carbon technologies as the world addresses this significant challenge.

Thank you for considering these comments. Please call me, at (650) 421 8141 with any questions.

Sincerely,



Alan Shaw, Ph.D.  
President and CEO  
Codexis, Inc.