DEPARTMENT OF ENERGY

Quadrennial Technology Review Framing Document
Request for Public Comment
76 Fed. Reg. 13,607 (March 14, 2011)

COMMENTS OF CODEXIS, INC.
Submitted: April 15, 2011

Codexis appreciates the opportunity to submit the following comments in response to the Department of Energy's (DOE) solicitation of public input on the DOE Quadrennial Technology Review (DOE-QTR) Framing Document.

Codexis, Inc. (NASDAQ: CDXS) is a global industrial biotechnology company, headquartered in Redwood City, California, focusing on cost-effective conversion of renewable resources into transportation fuels and chemicals, green biocatalytic manufacturing of pharmaceuticals, and new technologies for carbon capture. Codexis is developing technology that can meaningfully contribute to national energy goals of greenhouse gas reduction and petroleum displacement. Through low cost production of sugars from a variety of types of renewable biomass, including cellulosic feedstocks, Codexis can apply its technology in a manner that displaces the entire barrel of oil, not merely the portion used for transport fuels.

As Codexis aggressively advances biomass pathways to achieve our national energy goals by substantially displacing petroleum usage, we strongly support an expanded leadership role for DOE. The release of the Framing Document marks an important first step towards a sustained commitment to bold, new leadership from DOE that will enable companies like Codexis to scale through the facilitation of bioenergy technology invention, refinement, and early deployment.

The comments below focus on three areas where DOE specifically requested input from public stakeholders: (1) clean energy leadership; (2) the United States energy framework; and (3) DOE program definition and management.

I. Clean Energy Leadership

Transformational clean energy technology breakthroughs occurring at companies, universities, national laboratories and government agencies are at risk. The United States leads the world in information technology and biotechnology innovation, but we are falling behind in clean energy. South Korea outspends the U.S. government on energy innovation two to one as a percentage of gross domestic product. China is spending just one-sixth as much as the United States on military security but investing twice as much on climate security. With rising gas prices, a recovering economy, and significant doubt among many Americans about our nation's ability to lead, DOE must reaffirm the essential role of innovation in American leadership.

The private sector is doing its part by creating new companies that last and products actual customer will buy now. DOE should continue to do what it, as a government agency with energy technology mission and expertise, does best: provide early funding to facilitate clean energy technology's most promising concepts to achieve demonstration at pilot scale. ARPA-E has awarded more than $300 million in grants to transformational clean energy technologies. This program must be sustained. But support for ARPA-E should not come at the expense of DOE applied program funding. For example, the Biomass Program within the Office of Energy Efficiency and Renewable Energy is providing crucial support for biomass conversion technologies, supply chain logistics, and commercialization of promising engineering and technology advances. The pipeline within DOE – basic science to applied technology to first-of-a-kind scale-up and demonstration – should be strengthened and intentionally promoted to ensure that the continued taxpayer investment in clear energy R&D provides real, near-term returns.

II. United States Energy Framework

DOE solicits comment as to whether it has "correctly identified and structured" the six strategies for addressing the national energy goals. President Obama recently laid out a central goal that should formally recognized within three-part national energy goal framework presented in the DOE-QTR Framing Document—the goal of cutting petroleum imports by one-third by 2025. Codexis urges DOE to include this goal as a high priority national energy goal, and to specify near-term petroleum displacement milestones, including increased use of alternative fuels, in its strategy to achieve this goal.

DOE already recognizes the importance of reducing petroleum consumption and evaluates the merits of various transport strategies through this lens at numerous points throughout the DOE-QTR Framing Document. For example, DOE touts vehicle electrification as "a significant opportunity to **reduce petroleum consumption**, lower GHG emissions, and reduce air pollution." *See* Framing Document at p. 24 (emphasis added). The central importance of petroleum displacement is also emphasized in DOE's draft Strategic Plan. *See id.* at p. 5 (referencing the DOE draft Strategic Plan's assertion that "Petroleum use will be decreased by raising fuel economy standards, gradual electrification of the vehicle fleet, and increasing production of advanced biofuels."). Given that DOE stresses the need to eliminate dependence on petroleum, the QTR should formally recognize the President's goal of cutting the amount of petroleum imported into the United States to about 3.67 million barrels per day by 2021. DOE should also outline strategies to achieve this goal with specific milestones and metrics.

Without a concrete target for reducing petroleum consumption, the prioritization of deploying one million electric vehicles by 2015 lacks context and is a clear case of the government 'picking winners.' The other viable transport strategies—namely, efficiency and alternative fuels—also have a crucial complementary role to play in achieving petroleum reduction goals. Emphasizing this complementary approach is essential to a coherent framework. The progressive electrification of vehicles and improvements in fuel efficiency will only make meaningful near-term contributions to petroleum displacement (and greenhouse gas reduction) goals if they are complemented by major increases in alternative fuel production.

Liquid fuels can do things that electricity and efficiency cannot. As DOE recognizes, "certain segments of the transportation sectors (*e.g.*, HDVs, airplanes, and civilian ships) require the energy density of liquid fuels for effective operation." *Id.* at p. 26. Scaling the production of renewable diesel and other appropriate fuels is thus critical in this context.

A clearly defined petroleum reduction goal will also clarify that the path to cutting our dependence on oil involves more than simply supplanting gasoline or diesel—*entire* barrels of oil must be displaced. In this regard, biochemicals and bioproducts must be explicitly recognized as a priority. About one-quarter of every barrel of oil is used for purposes other than diesel, gasoline or jet fuel (e.g., petrochemicals).[1] Thus, as crude oil is displaced as a source of transport fuels, there may be shortfalls in other markets. While some biomass conversion technologies used to produce alternative fuels can displace the entire barrel of oil by also producing petrochemical and other alternative products, this is not universally true of all alternative fuels. We recommend that DOE clarify its intent to avoid creating shortages or gluts in other markets, with attendant economic consequences. But most importantly, DOE should recognize the critical importance of biomass conversion technologies that displace more than just transportation fuels; milestones and timetables for innovation in biochemicals and bioproducts are critical to securing America's energy future.

III. Program Definition and Management

In response to DOE's query as to how it can better "coordinate activities between the private sector, government laboratories and academia in accelerating technology innovation," we recommend the following:

- **Stakeholder Engagement.** DOE should provide more regular and transparent mechanisms to solicit stakeholder input to ensure program goals are oriented towards research and development investments that require federal participation. Issuing more frequent Requests for Information or white papers for public comment, convening stakeholder workshops, hosting technology showcases, and reaching out to industry groups are all means to engage the clean energy community as partners in developing and deploying advanced technologies. This is consistent with DOE's policy that public participation is an integral and effective part of DOE activities with many benefits.

- **Intra-agency Alignment.** DOE should align the goals of the applied technology programs and procurement offices under DOE's Technology Mission, so that DOE operates as an early adopter of technology as a part of a comprehensive commercialization focus. Aligning policy and procurement will provide DOE with an additional lever to bring down cost-curves and push technologies to market. Procurement policies should reflect a value proposition that includes attaining national energy goals, rather than a narrowly constructed cost-competitiveness metric.

[1] Energy Information Administration, "Oil: Crude Oil and Petroleum Products Explained" and AEO2009, Updated February 2010, Reference Case.

- **Interagency Alignment.** DOE should also assert a leadership role in interagency efforts to promote clean energy technology development and commercialization. As the primary science and technology arm of the federal government, DOE and its National Laboratories are best suited to proactively lead on energy policy development that promotes the widespread adoption of new technologies. DOE should work on an interagency basis to ensure that metrics and milestones can be met and that barriers are overcome.

- **Technology Information.** DOE should expand its role as an independent proactive source of technology information to the marketplace, combating inaccuracies that hamper consumer adoption. While DOE can not be expected to attest to the validity of individual products, the agency can and should do more to ensure that the public is aware of developments in clean energy technologies broadly.

DOE's role in building a clean energy economy is essential. Codexis is pleased to partner with DOE on technology research and development that advances the national energy priorities identified in the QTR Framing Document. Thank you for the opportunity to provide input into this important Framing Document.

Respectfully submitted,

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