October 24, 2014

California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95814

Re: Comments of America's Natural Gas Alliance on the LCFS Reconsideration: CA-GREET Model Update

Dear Members of the California Air Resources Board:

America's Natural Gas Alliance (ANGA) appreciates the opportunity to reiterate our comments submitted on September 22,2014 regarding the Air Resources Board's August 22, 2014 Workshop (Workshop) on the preliminary CA GREET Model Update.

Representing North America's leading independent natural gas exploration and production companies, America's Natural Gas Alliance (ANGA) works with industry, government and customer stakeholders to promote increased demand for and continued availability of our nation's abundant natural gas resource for a cleaner and more secure energy future.

We encourage CARB to incorporate the technical comments submitted by the California Natural Gas Vehicle Coalition (CNGVC), GVGAmerica (NGVA), and the Coalition for Renewable Natural Gas (CRNG). America's Natural Gas Alliance has significant concerns with the proposed changes to the CA-GREET model. It is not the appropriate time to adjust these standards.

We strongly urge you to delay adoption of the proposed revisions to CA-GREET until our concerns have been thoroughly addressed, and important new data from various ongoing studies can be incorporated. Please consider ANGA a resource and please contact Erica Bowman at ebowman@anga.us with any questions.

Sincerely,

Erica Bowman
Vice President, Research and Policy Analysis
America's Natural Gas Alliance

September 22, 2014

By E-Mail

California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95814

Re: Comments of America's Natural Gas Alliance on the LCFS Reconsideration: CA-GREET Model Update

Dear Members of the California Air Resources Board:

America's Natural Gas Alliance (ANGA) appreciates the opportunity to submit these comments on the Air Resources Board's August 22, 2014 Workshop (Workshop) on the preliminary CA-GREET Model Update.

Representing North America's leading independent natural gas exploration and production companies, America's Natural Gas Alliance (ANGA) works with industry, government and customer stakeholders to promote increased demand for and availability of our nation's abundant natural gas resources for a cleaner and more secure energy future. The collective natural gas production of the ANGA member companies is approximately eight trillion cubic feet per year, which represents one third of the total annual U.S. natural gas supply.

The safe and environmentally responsible development of domestic natural gas has been, and increasingly will be, an important component of America's energy supply and economic strength. Natural gas is a clean-burning, efficient, abundant, and cost-effective fuel that offers the potential for significantly decreasing air pollution emissions and promoting America's energy security.

We recognize that the Workshop was a preliminary presentation of potential changes to the CA-GREET Model and understand that work on a final CA-GREET 2.0 Model is ongoing. With that in mind, these comments are intended as a preliminary response to the information presented to date.

Benefits and Foundations of Modeling with GREET

The foundations common to all scientific modeling that allow for continued development of such models and their successful use in environmental regulation include:

- A sound scientific theory and associated experiments, which form the basis for the model.
- Stakeholder agreement on reasonable input assumptions to be used for model runs.
- High quality measurements of inputs and model parameters for each scenario evaluated.

- Appropriate model restrictions and computational approximations.
- Inclusion of uncertainty associated when reporting results.
- Subsequent interpretation and review of results with uncertainty by stakeholders.
- Periodic verification with appropriate real world data.
- Prudent and justified model and assumption updates.

ANGA examines modeling efforts with an eye toward each of these foundations to ensure continued, productive model and results development. We support model changes when it is clear that such changes will result in more accurate modeling. Differences in carbon intensities (CI) between the current CA-GREET 1.8b model and the CA-GREET 2.0 model are driven by natural gas system methane emission rates and pipeline energy requirements. It is unclear how such assumption updates will improve the accuracy of the model, especially given the uncertainty associated with real-world methane leakage rates and the lack of detailed description to justify the proposed pipeline energy requirement changes. Even if an update were deemed prudent, given the status of ongoing research to directly measure methane emissions and improve emission factors and the impending publication of those results, it would be advisable to delay such an update of the model.

Methane Emissions Estimates in Natural Gas Systems

As ARB correctly noted in their "Transportation Fuels ARB Technology Assessment"[1], there are numerous completed and ongoing studies trying to better quantify the actual methane emissions rate from natural gas systems. These studies range from annual reporting, such as the United States Environmental Protection Agency's (EPA) National Greenhouse Gas (GHG) Emissions Inventory, to industry, NGO and academic collaborative, direct measurement studies, such as the Environmental Defense Fund's (EDF) sixteen studies on methane across the supply chain, to ambient air assessments, such as the National Oceanic and Atmospheric Administration's (NOAA) work implementing top-down approaches to estimate methane emissions. Each of these studies and methods have benefits and limitations to their approach.[2] Additionally, each of these studies have found a different methane emissions rate from natural gas systems. While methane emissions assessments have been conducted for decades, the methodologies used to estimate methane emissions from natural gas systems continue to evolve as the natural gas system itself continues to evolve.

For example, since the 2012 EPA GHG Inventory release[3], methane emission estimates for natural gas systems decreased 37% for 2010 (the most recent year reported in the 2012 Inventory). Using the Energy Information Administration's natural gas gross production[4] (minus

[1] California Environmental Protection Agency - Air Resources Board, "Transportation Fuels, ARB Technology Assessment", September 3, 2014.
[2] ANGA acknowledges efforts to conduct top-down emission studies but believes those studies to date to be inferior to direct-measurement studies due to the inability to fully account for all of the activity on the ground that has the ability to impact atmospheric concentrations of methane. As such, we believe the direct-measurement studies are better suited to inform adjustments in emission rates.
[3] U.S. EPA, "Inventory of the U.S. Greenhouse Gas Emissions and Sinks 1990-2010", April 2012.
[4] EIA, "Natural Gas Gross Withdrawals and Production: 2010 Annual", Accessed September 18, 2014, http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_NUS_a.htm.

vented and flared methane), the implied natural gas system's methane emission rate was 2.0% in the 2012 EPA GHG Inventory release. In the 2014 EPA GHG Inventory release[5], the implied natural gas system's methane emission rate dropped to 1.3% for 2010. This reduction was due to EPA's changes in methodology as well as new data from the ANGA/API Methane study[6] and the Greenhouse Gas Reporting Program[7] (GHGRP) where petroleum and natural gas systems owners and operators are required to report GHG data to the EPA.

While in recent years EPA's natural gas systems emissions estimate has decreased year over year, we still believe EPA overestimates methane emissions, specifically in the field production category. Although EPA implemented new emission factors for uncontrolled well completions to better represent actual industry practices, they remain higher than measured results from the study by researchers at the University of Texas-Austin that was supported by Environmental Defense Fund (Allen, et al.[8]). The metric tons (MT) of methane per vented well completion is within one order of magnitude of the range found for similarly configured completions in the Allen, et al. study, which found a range of 0.5-4 MT methane per completion event for those wells vented directly to atmosphere. Much of this difference can be attributed to the choke flow calculation methodology option in the GHGRP. The choke flow calculation methodology was not designed for use in multi-phase flow applications, and as such can often deliver erroneous results when compared to direct measurement. This is just one example where a parameter used to determine total methane emissions is associated with a high error range.

We also anticipate changes to the natural gas system methane emissions profile due to significant changes in regulatory requirements that will be fully phased in as of 2015. The oil and natural gas new source performance standard[9] (NSPS) regulates volatile organic compounds (with methane reduction co-benefits) from hydraulically fractured gas wells, centrifugal compressors, reciprocating compressors, pneumatic controllers and storage tanks. This rule was finalized in 2012 requiring reduced emission completions on all hydraulically fractured wells and all new pneumatic controllers to be low bleed by January 1, 2015. Industry has been implementing green completions on the production side for many years. The Allen et al. study found that methane emissions from well completions were 97% lower than EPA inventory estimates released in 2013 and that the majority of hydraulically fractured wells already had equipment in place. While methane emissions from pneumatic devices were found to be approximately 70% higher, the study authors noted in their rollout of the study results that the sample size was insufficient and to draw conclusions about emission rates from pneumatics and recommended a follow up study with sufficient over-sampling to allow for a representative estimate of pneumatic emissions. Results from the follow up study are anticipated in the coming months. In the meantime, "no bleed" and low-bleed pneumatic devices are available to reduce

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[5] U.S. EPA, "Inventory of the U.S. Greenhouse Gas Emissions and Sinks 1990-2012", April 2014.
[6] ANGA/API, "Characterizing Pivotal Sources of Methane Emissions from Natural Gas Production", November 2012.
[7] U.S. EPA, "Subpart W – Petroleum and Natural Gas Systems", Accessed September 18, 2014, http://www.epa.gov/ghgreporting/reporters/subpart/w.html.
[8] Allen, et al. "Measurements of methane emissions at natural gas production sites in the United States", October 2013. Proc Natl Acad Sci USA 110(44): 17601-17602.
[9] U.S. EPA, "Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Review, Final Rule." *Federal Register* 77. August 16, 2012.

emissions and as stated above will be required by January 1, 2015. These actions will continue to put downward pressure on methane emissions.

Additionally, there are several other efforts underway at the federal level to address methane emissions. The EPA released methane white papers for public comment in April 15, 2014 with peer review comments posted in August, 2014. EPA has committed to making a decision about potential regulatory action in the fall of 2014 with any new rulemaking completed by the end of 2016. EPA also proposed the Natural Gas STAR Gold framework released May 8, 2014 with stakeholder comments due September 30, 2014. The Department of Energy hosted several methane roundtables between March and July of this year to help identify and develop strategies to reduce methane emission from the natural gas value chain. And finally, the Bureau of Land Management announced it would draft a proposed rule to reduce flaring and venting of methane from production on Federal and Indian lands.

With estimates from the EPA in recent years showing declines in methane emission from natural gas systems, the first study, Allen et al., directly measuring methane at the source during production finding methane emissions to be lower than EPA inventory estimates and existing regulations coming fully into effect in 2015, it is counterintuitive that the Air Resources Board would recommend a doubling of methane emissions from natural gas systems. While ARB details various methane emission studies at the national and regional level, it is also unclear why ARB decides the updated leakage rate should be doubled. Given these issues, ANGA strongly recommends that the Air Resources Board makes no change to the methane emissions rate from natural gas systems currently used in the CA-GREET 2.0 model until more of the ongoing studies have been completed and GHGRP data incorporates the 2015 implementation of the oil and gas NSPS. If and when ARB does move forward with an update, we request that the board provide additional detail on the current GREET model assumptions and clearly lays out the basis for the current leakage rate as well as the calculations for any adjustment to that leakage rate.

Pipeline Energy Requirements

As stated previously, ANGA was unable to find justification and data support for the increase in pipeline energy requirements for CA GREET 2.0. Until such justification and data is transparent and easily able to be reviewed, ANGA requests that ARB not update this parameter in CA-GREET 2.0.

Conclusion

While these comments are focused on model parameter updates, such changes can have real world impact, including but not limited to, the adoption rate of alternative fuels. To achieve the goals set forth in California's LCFS, the standard must be credible, stable and predictable. Such credibility and stability comes not only from the inclusion of reasonable data, but also from patience to abstain from premature model updates while data and methodologies are in continuous flux.

ANGA appreciates the opportunity to comment on the CA-GREET model update. We stand ready to continue to work with ARB to develop valid model parameters as it relates to natural

gas systems. If you have any questions, please contact Erica Bowman at ebowman@anga.us or (202) 789-2642.

Sincerely,

Erica Bowman
Vice President, Research and Policy Analysis
America's Natural Gas Alliance