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POET Comments on the California Energy Commission's Transportation Fuels Assessment

Additional submitted attachment is included below.

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California Energy Commission
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RE: POET Comments on the California Energy Commission's Transportation Fuels Assessment

POET, the world's largest producer of biofuels, is pleased to submit comments in response to the California Energy Commission's (CEC) Transportation Fuels Assessment Workshop on August 17, 2023. POET shares CEC's concerns regarding high fuel prices in California. We write to call the Commission's attention to E15 as an immediate, cost-effective, and sustainable fuel option. While the staff presentation at the August 17 Workshop reflected consideration of E15 as a longer-term solution, E15 should be considered an attractive and viable option now. Accelerating the availability of E15 would reduce gasoline prices, lower greenhouse gas (GHG) emissions, and cut petroleum consumption by increasing the availability and use of sustainable low-carbon biofuel blends.

I. ABOUT POET

POET's vision is to create a world in sync with nature. As the world's largest producer of biofuel and a global leader in sustainable bioproducts, POET creates plant-based alternatives to fossil fuels that unleash the regenerative power of agriculture and cultivate opportunities for America's farm families. Founded in 1987 and headquartered in Sioux Falls, POET operates 34 bioprocessing facilities across eight states and employs more than 2,200 team members. With a suite of bioproducts that includes POET Distillers Grains, POET Distillers Corn Oil, POET Purified Alcohol, and POET Biogenic CO_2, POET nurtures an unceasing commitment to innovation and advances powerful, practical solutions to some of the world's most pressing challenges. Today, POET holds more than 80 patents worldwide and continues to break new ground in biotechnology, yielding ever-cleaner and more efficient renewable energy. POET is also a leading champion for nationwide access to E15, a renewable fuel blend made with 15% bioethanol. In 2021, POET released its inaugural Sustainability Report pledging carbon neutrality by 2050.

II. TRANSPORTATION FUEL ASSESSMENT WORKSHOP

Under Senate Bill (SB) X1-2, CEC is required to conduct a triennial assessment of transportation fuels and identify methods to ensure a reliable supply of transportation fuel in California.[1] CEC must evaluate the market conditions that impact the price of transportation fuels and propose solutions to mitigate these impacts.[2] As part of this evaluation, CEC must examine the price of "alternative formulations of gasoline with lower carbon impact[s]."[3] POET urges CEC to recognize E15 as a short-term solution in this assessment.

California gasoline is by far the most expensive in the country. Slide 14 of CEC's workshop presentation shows increased retail gasoline prices since December 2022.[4] By increasing bioethanol blends in gasoline, California could lower gas prices and reduce transportation GHG emissions simultaneously. Access to E15 is rapidly expanding across the United States, delivering cost savings for consumers and emissions reductions in major fuel markets outside California. Currently, California and Montana are the only states where sales of E15 are not permitted.

The California Air Resources Board is currently conducting the Multimedia Evaluation for E15 for use in California.[5] If approved for use in California, E15 will help decarbonize millions of legacy vehicles, displace hazardous chemicals in gasoline, and save drivers more money when they fill up.

- **E15 can increase fuel savings for most Californians.** According to Oil Price Information Service (OPIS) data, the average price of E15 from May through August 2022 was 16 cents per gallon below that of regular unleaded (E10) gasoline.[6] These cost savings increase as the price of petroleum increases. Increasing the amount of bioethanol in the fuel supply boosts octane while reducing benzene, toluene, ethylbenzene, and xylene (BTEX) – expensive aromatic hydrocarbons that make up an average of 20 percent of each gallon of gasoline.
- **E15 is more environmentally sustainable than standard gasoline.** Reducing vehicle emissions is critical to California achieving its climate and air quality goals. Bioethanol continues to cut lifecycle GHG emissions, and improvements are accelerating over time. A study by Environmental Health & Engineering, Inc., a multi-disciplinary team of environmental health scientists and engineers from Harvard and Tufts Universities, found that corn-based bioethanol has a 46% lower lifecycle carbon intensity on average than gasoline.[7] This confirms recent studies conducted by the Department of Energy and Department of Agriculture showing that bioethanol reduces lifecycle emissions by 43-

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[1] CAL. PUB. RES. CODE § 25371 (Westlaw through Ch. 101 of 2023 Reg. Sess.).
[2] § 25371(a)(1)(F).
[3] Id at (a)(1)(B).
[4] https://efiling.energy.ca.gov/GetDocument.aspx?tn=251689
[5] California Multimedia Evaluation of E15, California Air Resources Board (last visited Aug. 29, 2023), https://ww2.arb.ca.gov/resources/documents/fuels-multimedia-evaluation-e15.
[6] Urbanchuk, John, *Consumer Savings from Year-Round Nationwide E15 Use*, ABF ECONOMICS, 5 (Oct. 2022), https://growthenergy.org/wp-content/uploads/2022/10/ABF-E15-Consumer-Savings-101322.pdf.
[7] Sully, Melissa *et al.*, *Carbon intensity of corn ethanol in the United States: state of the science*, 2021 ENVIRON. RES. LETT. 16 043001, 4 (2021), https://iopscience.iop.org/article/10.1088/1748-9326/abde08.

52% compared to gasoline.[8] Studies have also shown that shifting from E10 to E15 in California would cut 1.8 million metric tons of GHG emissions annually, equivalent to removing more than 411,000 cars off the road.[9]

- **E15 can reduce harmful tailpipe pollution that disproportionately impacts low-income communities.** POET and the biofuel industry have been working with CARB for several years on the Multimedia Evaluation for E15, and California-specific data is now available to support the sale of E15 in the state. CARB recently completed tailpipe and evaporative emissions testing of E15 in partnership with the University of California, Riverside. The results of those studies, using California fuels and matching pairs of used vehicles, showed that E15 reduced carbon monoxide (CO), particulates (PM2.5), volatile organic compounds (VOCs), and GHGs with no increase in nitrogen oxide (NOx).[10] Additionally, higher bioethanol blends like E15 reduce air toxic emissions like BTEX.[11] These tailpipe emissions reduction benefits show that E15 improves air quality and public health, particularly for environmental justice communities.

- **E15 complements California's transportation decarbonization strategies.** Authorizing the use of E15 would help California achieve its transportation decarbonization goals more quickly. While the state transitions the new vehicle fleet toward ZEVs, it should also implement a strategy to reduce the climate impact of the more than 30 million legacy vehicles that will remain on the road for decades. E15 can be used in most existing retail fueling infrastructure, and E15 is EPA-approved for 96% of light-duty vehicles. E15 can therefore reduce legacy vehicle emissions significantly while delivering meaningful fuel savings to Californians, especially those who cannot afford to buy new vehicles.

* * *

POET shares CEC's priorities of establishing a reliable, safe, and affordable fuel supply. E15 is a proven and available emissions reduction technology that meets California's climate goals and achieves the state's desire for widespread fuel savings across the state. POET appreciates the opportunity to comment and looks forward to working with CEC to provide Californians with cleaner renewable fuel options like E15. If you have any questions, please contact me at Josh.Wilson@POET.COM or (202)756-5612.

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[8] *A Life-Cycle Analysis of the Greenhouse Gas Emissions from Corn-Based Ethanol*, U.S. DEPARTMENT OF AGRICULTURE PREPARED BY ICF (Sept. 2018), https://www.usda.gov/sites/default/files/documents/LCA_of_Corn_Ethanol_2018_Report.pdf; Lee, U., Kwon, H., Wu, M. and Wang, M. (2021), *Retrospective analysis of the U.S. corn ethanol industry for 2005–2019: implications for greenhouse gas emission reductions,* BIOFUELS, BIOPRODUCTS AND BIOREFINING (2021), https://doi.org/10.1002/bbb.2225.

[9] *GHG Benefits of 15% Ethanol (E15) Use in the United States*, AIR IMPROVEMENT RESOURCE INC, 4 (Nov, 30, 2020), http://www.airimprovement.com/reports/national-e15-analysis-final.pdf.

[10] *Comparison of Exhaust Emissions Between E10 CaRFG and Splash Blended E15*, UNIVERSITY OF CALIFORNIA, RIVERSIDE (June 2022), https://ww2.arb.ca.gov/sites/default/files/2022-07/E15_Final_Report_7-14-22_0.pdf.

[11] See Attachment A.

Sincerely,

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February 3, 2022

Docket Number: EPA-HQ-OAR-2021-0324

Comments of Drs. Fatemeh Kazemiparkouhi,[1] David MacIntosh,[2] Helen Suh[3]
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[3] Tufts University, Medford, MA

We are writing to comment on issues raised by the proposed RFS annual rule, the Draft Regulatory Impact Analysis (December 2021; EPA-420-D-21-002), and the supporting Health Effects Docket Memo (September 21, 2021; EPA-HQ-OAR-2021-0324-0124), specifically regarding the impact of ethanol-blended fuels on air quality and public health. We provide evidence of the air quality and public health benefits provided by higher ethanol blends, as shown in our recently published study[1] by Kazemiparkouhi et al. (2021), which characterized emissions from light duty vehicles for market-based fuels. Findings from our study demonstrate ethanol-associated reductions in emissions of primary particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), and to a lesser extent total hydrocarbons (THC). Our results provide further evidence of the potential for ethanol-blended fuels to improve air quality and public health, particularly for environmental justice communities. Below we present RFS-pertinent findings from Kazemiparkouhi et al. (2021), followed by their implications for air quality, health, and environmental justice.

Summary of Kazemiparkouhi et al. (2021)

Our paper is the first large-scale analysis of data from light-duty vehicle emissions studies to examine real-world impacts of ethanol-blended fuels on regulated air pollutant emissions, including PM, NOx, CO, and THC. To do so, we extracted data from a comprehensive set of emissions and market fuel studies conducted in the US. Using these data, we (1) estimated composition of market fuels for different ethanol volumes and (2) developed regression models to estimate the impact of changes in ethanol volumes in market fuels on air pollutant emissions for different engine types and operating conditions. Importantly, our models estimated these changes accounting for not only ethanol volume fraction, but also aromatics volume fraction, 90% volume distillation temperature (T90) and Reid Vapor Pressure (RVP). Further, they did so

[1] https://doi.org/10.1016/j.scitotenv.2021.151426

under both cold start and hot stabilized running conditions and for gasoline-direct injection engines (GDI) and port-fuel injection (PFI) engine types. Key highlights from our paper include:

- ***Aromatic levels in market fuels decreased by approximately 7% by volume for each 10% by volume increase in ethanol content*** (Table 1)**.** Our findings of lower aromatic content with increasing ethanol content is consistent with market fuel studies by EPA and others (Eastern Research Group, 2017, Eastern Research Group, 2020, US EPA, 2017). As discussed in EPA's Fuel Trends Report, for example, ethanol volume in market fuels increased by approximately 9.4% between 2006 and 2016, while aromatics over the same time period were found to drop by 5.7% (US EPA, 2017).

  We note that our estimated market fuel properties differ from those used in the recent US EPA Anti-Backsliding Study (ABS), which examined the impacts of changes in vehicle and engine emissions from ethanol-blended fuels on air quality (US EPA, 2020). Contrary to our study, ABS was based on hypothetical fuels that were intended to satisfy experimental considerations rather than mimic real-world fuels. It did not consider published fuel trends; rather, the ABS used inaccurate fuel property adjustment factors in its modeling, reducing aromatics by only 2% (Table 5.3 of ABS 2020), substantially lower than the reductions found in our paper and in fuel survey data (Kazemiparkouhi et al., 2021, US EPA, 2017). As a result, the ABS's findings and their extension to public health impacts are not generalizable to real world conditions.

Table 1. Estimated market fuel properties

Fuel ID	EtOH Vol (%)	T50 (^oF)	T90 (^oF)	Aromatics Vol (%)	AKI	RVP (psi)
E0	0	219	325	30	87	8.6
E10	10	192	320	22	87	8.6
E15	15	162	316	19	87	8.6
E20	20	165	314	15	87	8.6
E30	30	167	310	8	87	8.6

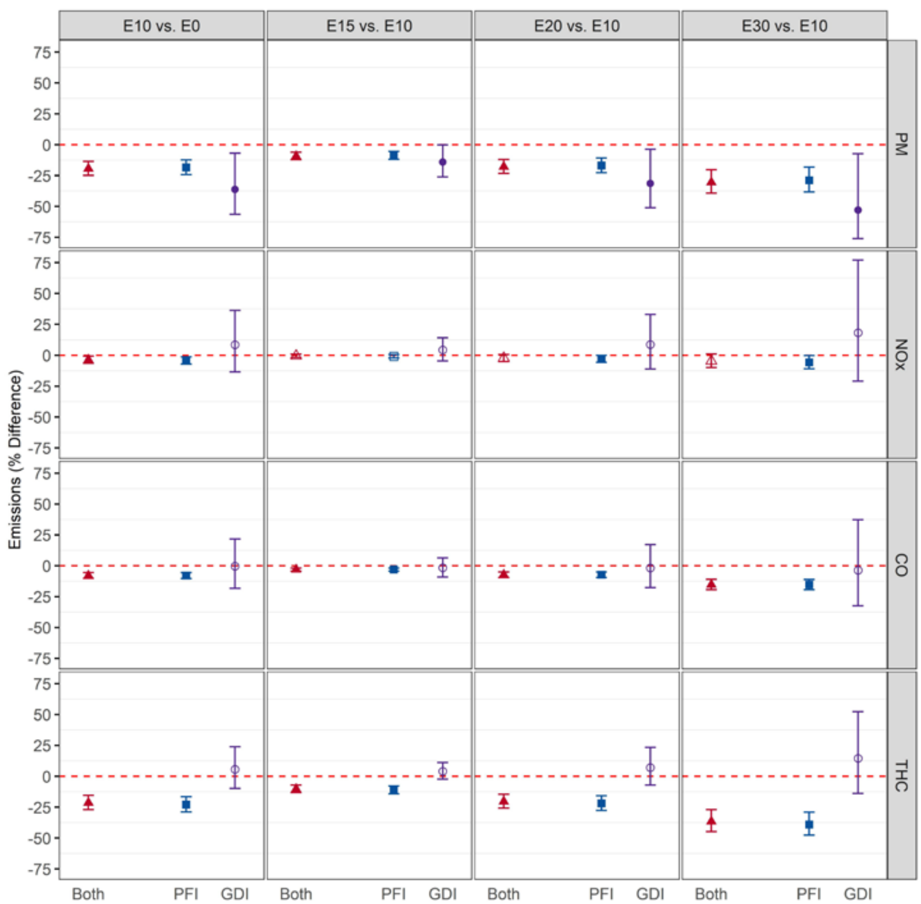
Abbreviations: EtOH = ethanol volume; T50 = 50% volume distillation temperature; T90 = 90% volume distillation temperature; Aromatics=aromatic volume; AKI = Anti-knock Index; RVP = Reid Vapor Pressure.

- ***PM emissions decreased with increasing ethanol content under cold-start conditions.*** Primary PM emissions decreased by 15-19% on average for each 10% increase in ethanol content under cold-start conditions (Figure 1). While statistically significant for both engine types, PM emission reductions were larger for GDI as compared to PFI engines, with 53% and 29% lower PM emissions, respectively, when these engines burned E30 as compared to E10. In contrast, ethanol content in market fuels had no association with PM emissions during hot-running conditions.

  Importantly, our findings are consistent with recent studies that examined the effect of ethanol blending on light duty vehicle PM emissions. Karavalakis et al. (2014), (2015), Yang et al. (2019a), (2019b), Schuchmann and Crawford (2019), for example, assessed the influence of different mid-level ethanol blends – with proper adjustment for aromatics – on the PM emissions from GDI engines and Jimenez and Buckingham (2014) from PFI engines. As in our study, which also adjusted for aromatics, each of these recent studies found higher ethanol blends to emit lower PM as compared to lower or zero ethanol fuels.

Together with these previous studies, our findings support the ability of ethanol-blended fuels to offer important PM emission reduction opportunities. **Cold start PM emissions have consistently been shown to account for a substantial portion of all direct tailpipe PM emissions from motor vehicles**, with data from the EPAct study estimating this portion to equal 42% (Darlington et al., 2016, US EPA, 2013). The cold start contribution to total PM vehicle emissions, together with our findings of emission reductions during cold starts, suggest that a **10% increase in ethanol fuel content from E10 to E20 would reduce total tailpipe PM emissions from motor vehicles by 6-8%.**

Figure 1. Change (%) in cold-start emissions for comparisons of different ethanol-content market fuels[a]



[a] Emissions were predicted from regression models that included ethanol and aromatics volume fraction, T90, and RVP as independent variables

- **NOx, CO and THC emissions were significantly lower for higher ethanol fuels for PFI engines under cold-start conditions**, but showed no association for GDI engines (Figure 1). CO and THC emissions also decreased under hot running conditions for PFI and for CO also for GDI engines (results not shown). [Note that NOx emissions for both PFI and GDI engines were statistically similar for comparisons of all ethanol fuels, as were THC emissions for GDI engines.] These findings add to the scientific evidence demonstrating emission reduction benefits of ethanol fuels for PM and other key motor vehicle-related gaseous pollutants.

Implications for Public Health and Environmental Justice Communities

The estimated reductions in air pollutant emissions, particularly of PM and NOx, indicate that increasing ethanol content offers opportunities to improve air quality and public health. As has been shown in numerous studies, lower PM emissions result in lower ambient PM concentrations and exposures (Kheirbek et al., 2016, Pan et al., 2019), which, in turn, are causally associated with lower risks of total mortality and cardiovascular effects (Laden et al., 2006, Pun et al., 2017, US EPA, 2019, Wang et al., 2020).

The above benefits to air quality and public health associated with higher ethanol fuels may be particularly great for environmental justice (EJ) communities. EJ communities are predominantly located in urban neighborhoods with high traffic density and congestion and are thus exposed to disproportionately higher concentrations of PM emitted from motor vehicle tailpipes (Bell and Ebisu, 2012, Clark et al., 2014, Tian et al., 2013). Further, vehicle trips within urban EJ communities tend to be short in duration and distance, with approximately 50% of all trips in dense urban communities under three miles long (de Nazelle et al., 2010, Reiter and Kockelman, 2016, US DOT, 2010). As a result, a large proportion of urban vehicle trips occur under cold start conditions (de Nazelle et al., 2010), when PM emissions are highest. Given the evidence that ethanol-blended fuels substantially reduce PM, NOx, CO, and THC emissions during cold-start conditions, it follows that ethanol-blended fuels may represent an effective method to reduce PM health risks for EJ communities.

Summary

Findings from Kazemiparkouhi et al. (2021) provide important, new evidence of ethanol-related reductions in vehicular emissions of PM, NOx, CO, and THC based on real-world fuels and cold-start conditions. Given the substantial magnitude of these reductions and their potential to improve air quality and through this public health, our findings warrant careful consideration. Policies that encourage higher concentrations of ethanol in gasoline would provide this additional benefit. These policies are especially needed to protect the health of EJ communities, who experience higher exposures to motor vehicle pollution, likely including emissions from cold starts in particular, and are at greatest risk from their effects.

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