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Attention: NHTSA Docket ID No. NHTSA-2018-0067
U.S. EPA Docket ID No. EPA-HQ-OAR-2018-0283

Re: Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks

Dear Mr. Lieske and Mr. Tamm:

I am the President of H-D Systems, a Washington-based consulting firm specializing in automotive technology, emissions, and fuels. I previously submitted a comment in October 2018 at the request of the California Department of Justice on behalf of the California Air Resources Board.[1] Toyota Motor North America, Inc. submitted a supplemental comment dated March 25, 2019 that refers to technology effectiveness estimates in my October 2018 comment. Upon review, I believe that Toyota's comments do not reflect substantive disagreement with my analysis. In fact, some of Toyota's comments provide factual and analytic support for the conclusions in my original report that EPA's and NHTSA's (Agencies') 2016 analysis of the existing standards' costs of compliance remains appropriate. Therefore, I am submitting this supplemental comment containing material "of central relevance to the rule making" (42 U.S.C. § 7607(d)(4)(B)(i)) to clarify the record.[2]

The Agencies Erroneously Excluded Next-Generation Atkinson Technology.

Toyota's discussion of HCR2 technology does not refute—and in fact supports—my conclusion that the Agencies erroneously excluded next-generation Atkinson technology from the Volpe model. "HCR2" is an agency-invented catch-all term for a suite of technological improvements to HCR1. In Toyota's March 25 supplemental comment, Toyota states that its improvements over HCR1 included in the 2018 Camry 2.5L engine are: cooled-exhaust gas recirculation (CEGR); optimized engine bore/stroke ratio, piston design, and intake/exhaust port shaping; high energy ignition coil; an electronic water pump; and a variable oil pump.[3] Referencing comments by the California Air Resources Board that the 2018 Camry 2.5L engine achieves similar efficiency to the Agencies' modeled HCR2 engine, Toyota agrees that "[t]his performance level should be expected as the 2018 2.5L Camry is equipped with CEGR, a high

[1] K. Gopal Duleep, Review of the Technology Costs and Effectiveness Utilized in the Proposed SAFE Rule, October 2018.
[2] Because Toyota's comments were submitted after the comment deadline, this response to Toyota's supplemental comments necessarily comes after the comment deadline. Moreover, this comment attaches a study published by EPA staff in April 2019.
[3] Supplemental Comments of Toyota Motor North America, Inc. at 1.

energy ignition coil, and other combustion design advancements that extend beyond the Agencies' definition of HCR1."[4] But the Agencies artificially excluded already-deployed Atkinson technologies from the Volpe model that have achieved real-world efficiencies beyond HCR1. Thus, their cost of compliance modeling does not capture these real-world, already-deployed improvements.

Moreover, EPA recently performed benchmark testing of the 2018 Camry 2.5L engine and published the resulting data in April 2019. It found that the Camry engine produces fuel efficiency and engine maps very similar to EPA's estimate of HCR2 technology in the 2017 Final Determination.[5] The results demonstrate that advanced Atkinson technologies already exist in the market and generate meaningful fuel efficiency gains over HCR1. The Agencies' justifications for omitting HCR2 from the Notice of Proposed Rulemaking that "the engine map [generated by EPA in 2016] has not been validated with hardware and bench data," and that "there has been no observable physical demonstration of the speculative technology" are incorrect.[6] Accordingly, the Agencies erred by omitting those technologies from the Volpe model on the ground that they are too speculative.

Toyota comments on only a single aspect of my report, specifically on my reference to HCR2 technology effectiveness of approximately 19 percent. I did not create this estimate. As Table 3-6 of my report shows, it comes from the Agencies' 2018 Preliminary Regulatory Impact Analysis's estimate of 18.6 percent and the 2016 Lumped Parameter Model's estimate of 19.8 percent. The Agencies' values were averaged and then verified against the 2018 Camry 2.5L data to arrive at an HCR2 effectiveness estimate of approximately 19 percent. The Agencies' estimates include the benefits of HCR2 and other technologies because they measure greenhouse gas reduction relative to an average 2016 vehicle that does not include other fuel-saving technologies typically found in vehicles with HCR2. While Toyota's comments suggest that I misattributed the entire 19 percent greenhouse gas reduction to HCR2, I acknowledged in my report that the estimates include the benefit of other technologies in addition to HCR2.[7]

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[4] Supplemental Comments of Toyota Motor North America, Inc. at 3. The 2018 Toyota Camry 2.5L engine is consistent with the Agencies' definition of HCR2 aside from only a few technologies (it lacks a 14:1 compression ratio and cylinder deactivation).

[5] Kargul, et al., Benchmarking a 2018 Toyota Camry 2.5-Liter Atkinson Cycle Engine with Cooled-EGR, SAE International, April 2, 2019, at 17 Table 7, 18 (concluding that the 2018 Camry 2.5L engine data "confirms the 3-4 percent effectiveness used for the 2017 Final Determination was appropriate, though perhaps conservative."), 16-17, 22 ("The Toyota [Camry engine], both in terms of amount of cEGR and CO_2 emission reduction, is in good agreement with data from earlier phases of EPA's demonstration program for its concept for a Future Atkinson engine with cEGR."); Kargul, et al., Benchmarking a 2018 Toyota Camry 2.5-liter Atkinson Cycle Engine with Cooled-EGR, SAE International WCX Detroit, April 9-11, 2019, at 22. This study and presentation are material "of central relevance to the rule making" (42 U.S.C. § 7607(d)(4)(B)(i)) and are attached to this comment for inclusion in the record.

[6] Notice of Proposed Rulemaking, 83 Fed. Reg. at 43038.

[7] K. Gopal Duleep, Review of the Technology Costs and Effectiveness Utilized in the Proposed SAFE Rule, October 2018, at vi, 23 Table 3-6.

The Camry can Meet Existing Standards Without Hybridization

Toyota's comments also highlight the feasibility of the existing standards. Toyota mentions, but does not contest, the ICCT study's finding that the base-level 2018 2.5L Camry configuration achieves its 2022 model year target, and can meet its 2025 target by adding available, existing technologies. Toyota further demonstrates that even its higher trim 2018 Camry LE/SE configurations achieve emissions of 171 g/mi, which would meet their 2022 target of 177.6 g/mi when 28.8 g/mi of off-cycle, AC efficiency, and AC leakage credits are included.[8] Achieving the 2025 model year target of 154.6 g/mi[9] would require only low-cost upgrades such as adding start/stop and active aerodynamics—technologies whose fuel savings to consumers easily exceed their costs. Additionally, the recent EPA study benchmarking the 2.5L Camry engine cited above also simulates a 2025 "exemplar" vehicle with the engine map derived from the 2018 Camry engine and estimates that it can attain 168.4 g/mi CO_2. Subtracting 28.8 g/mi derived from air-conditioner and off-cycle credits, the simulated vehicle exceeds its 2025 target. Toyota's comments suggest that the 2025 model year standards are infeasible because Toyota's sales-weighted fleet has not met them seven years in advance. If anything, the fact that existing Toyota Camry configurations already meet their 2022 model year target and could exceed their 2025 model year target using existing technologies demonstrates that the standards are feasible without resorting to the use of hybrid technology, in this case.

Atkinson Technology Applies Equally to Light-Duty Truck Applications.

Toyota's comments next state that "it is unreasonable to expect the 2016-2018 Tacoma … to approach the fuel economy and CO_2 performance of the 2018 Camry…."[10] The existing standards do not expect a light-duty truck to have similar fuel economy and CO_2 performance to passenger cars—the light truck standards at the same footprint establish higher GHG emissions targets than the car standards. Toyota's comments state that the Tacoma's performance requirements limit the level of Atkinson operation, but efficient engines like the 2018 Camry 2.5L can be scaled up in displacement to meet the power needs of larger vehicles like the Tacoma.[11] Similarly, Toyota's comments note that some technologies in the Camry engine, such as an electric water pump, are absent from the Tacoma engine because they have insufficient capacity to meet the Tacoma's greater performance demands. However, while the Tacoma engine may lack those technologies now, nothing prevents Toyota from building larger electrically driven components appropriate for the larger Tacoma engine in the future.

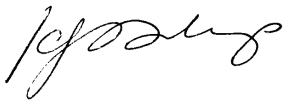
Conclusions

Thus, as discussed above, Toyota's supplemental comments do not contradict—and indeed support—my conclusions that the Agencies have exaggerated the cost of meeting the

[8] Supplemental Comments of Toyota Motor North America, Inc. at 4.
[9] Based on the wheelbase of 111.2 inches and average track width of 62.7 inches for the 2018 Camry LE/SE.
[10] Supplemental Comments of Toyota Motor North America, Inc. at 6.
[11] I also note that the 2019 RAV4 SUV offers the same engine and transmission as the 2018 Camry.

existing standards in the 2018 SAFE proposal and that the Agencies' 2016 findings supporting those existing standards remain appropriate.

Sincerely,



G. Duleep