3500 Deer Creek Road, Palo Alto CA 94304

P 650 681 5100 F 650 681 5101

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Clerk of the Board
California Air Resources Board (CARB)
1001 I Street
Sacramento, CA 95814

Re: Comments on Draft Regulations and Cost Study Issued in the Advanced Clean Fleets Rulemaking

Tesla appreciates the opportunity to submit these comments regarding the draft materials and regulations issued by staff in the Advanced Clean Fleets (ACF) Rulemaking. These materials include the draft ACF regulations, the proposed 100% zero emission vehicle (ZEV) sales requirement as well as the draft Total Cost of Ownership discussion document (TCO study). In these comments, Tesla focuses on the following areas:

- Several of the assumptions used in the TCO study, particularly related to battery electric heavy-duty vehicles, should be modified to produce a more realistic estimate of the cost effectiveness of Class-8 battery electric vehicles (BEVs).
- The 100% sales mandate should be accelerated to 2035.
- The High Priority and Federal Fleets regulation should incorporate credit generation, banking and trading provisions to provide obligated entities additional compliance flexibility, as well as to promote early action and compliance beyond the floors set by the regulation.

The TCO study relies on very conservative assumptions, particularly those related to battery electric heavy-duty ZEVs, resulting in a significant understatement of cost effectiveness.

Tesla understands that one of the factors motivating the TCO study is to assess whether the proposed ACF regulations would, by requiring fleet owner/operators to rely increasingly on ZEVs, result in adverse economic consequences relative to continued reliance on conventional vehicles. Given the role the TCO study is intended to play, Tesla can appreciate that reliance on conservative assumptions may be preferable to more optimistic assumptions. A finding of cost effectiveness can be considered that much more robust if, despite the use of highly conservative assumptions, ZEVs are found to be cost effective. Tesla further understands how this type of quasi "bookend study" can provide regulators some additional comfort in moving forward with far-reaching and impactful regulations like those being contemplated as part of this rulemaking. However, in developing the TCO study, ARB staff has not expressly acknowledged just how conservative many of the assumptions are. Further, in many cases, Tesla feels that the assumptions are not just conservative but unduly pessimistic, particularly those assumptions used to evaluate the total cost of ownership of day cabs and sleeper cabs.

This is problematic for a number of reasons. As a matter of principle, it is incumbent on staff to develop a study that provides decision-makers a realistic appraisal of the cost effectiveness of ZEVs. Tesla is especially concerned with several of the assumptions regarding heavy duty BEVs, which paint an unduly negative picture of the economics of these vehicles relative to the other vehicles to which they are being compared. This is a key point – while Tesla strongly supports the topline conclusion that overall ZEVs are cost effective relative to ICE vehicles across the relevant timeframes being studied, when one disaggregates the results to specific vehicle types, the story becomes more muddled, with the study

suggesting that heavy duty BEVs (specifically sleeper cabs) are not cost effective in 2025 and are only marginally so in 2030 and 2035. Such a conclusion has significant policy implications both within the context of the ACF rulemaking but also beyond it, as these findings could certainly spill over into other venues.

As ARB is keenly aware, its deliberations reverberate nationally and, indeed, globally. As such, ARB has a unique responsibility to ensure that the record it develops and bases decisions on is as robust and grounded in reality as possible. To that end, Tesla encourages ARB to reconsider some of the input assumptions to ensure they are more reflective of what can be reasonably anticipated. Alternatively, ARB could consider including some sensitivity analyses, particularly for the most impactful variables, to show the range of credible outcomes based on different input assumptions. Presenting a point estimate for TCOs as the current TCO study does, gives a false sense of precision and fails to acknowledge the uncertainty with which this type of exercise is inherently fraught.

Below Tesla provides our perspective regarding several input assumptions that we feel are unnecessarily, and, often, unrealistically conservative.

Upfront Vehicle Costs

Tesla finds ARB's assumed upfront vehicle cost assumptions to be quite high for day cabs and sleeper cabs relative to our publicized pricing for the Tesla Semi. Whereas ARB assumes a cost of $200K-$300K in 2025 for day and sleeper cabs, we anticipate the base prices to start at $150 and $180k for the 300 and 500-mile range variants respectively.[1] As discussed further below, ARB's high estimates are based on underlying, bottoms-up assumptions that, when combined, result in an estimated total cost that appears to be much higher than what Tesla believes is reasonable, particularly in the timeframes covered by the study.

Battery Costs

The TCO study assumes that reductions in battery costs for heavy duty vehicles will lag those of light duty vehicles by five years. The cost study offers very limited rationale for this, stating only that "Battery pack cost for medium- and heavy-duty applications are higher than for light-duty cars due to smaller volumes and differing packaging requirements even though they use the same cells."[2] With regards to volume, while heavy duty vehicles make up a small percentage of the vehicles on the road, their higher energy requirements necessitate more battery energy, and thus cells. A heavy-duty vehicle, depending on the application, will require several factors, in some cases up to 10x, more cells than a light-duty vehicle, which effectively decreases the volume difference. To the degree that the majority of a battery pack's costs are associated with the cells, and furthermore that these cells are essentially identical to the cells used in light duty applications, it follows that the entirety of the price differential ARB assumes is due to the relative cost of packaging requirements to create a battery pack. While there are differences in these packaging requirements, these differences might not always result in more packaging cost. The size and architecture of heavy-duty vehicles allows for different packaging geometries. Many light-duty vehicle battery packs vary in height due to the packaging constraints in the vehicle. Heavy-duty vehicles allow the batteries to be more cubic, with lower surface area to volume

[1] https://www.tesla.com/semi

[2] Draft Advanced Clean Fleets Total Cost of Ownership Discussion Document, p. 14

ratios that allow for cells to be packaged more efficiently. The result is less structure to support a higher number of cells. This can often offset the harsher mechanical duty cycles that heavy duty vehicles endure. Additionally, ARB's assumptions do not appear to factor in other innovations that can be reasonably anticipated to further reduce the costs of batteries. For example, in September of 2020, Tesla discussed our efforts to develop the 4680 battery cell, which, along with improvements in manufacturing, we anticipate resulting in a 56% reduction in battery costs.[3]

For these reasons, Tesla encourages ARB to adjust its assumed battery costs applied to MD and HD battery electric vehicles to mirror those of the light-duty segment. Or, at a minimum, to run a sensitivity analysis around this variable to include a scenario where battery prices for MD and HD vehicles track those in the LD segment.

Battery Size

The assumed battery sizes ARB modeled to derive the costs of BEV day and sleeper cabs appear quite high. As an initial matter, Tesla is unclear how ARB arrived at the assumed 1,050 kWh battery pack for a sleeper cab based on the input assumptions ARB provided. For the sleeper cab, assuming a 2.1 kWh/mile efficiency and a daily duty cycle calling for 320 miles of range and adding a 35% buffer, the battery size should be (320 miles * 2.1 kWh/mile *1.35 =) 907.2 kWh, not 1,050 kWh as used in the draft cost study. Additionally, these battery sizes seem high based on the indicative efficiency numbers that Tesla has provided for the Tesla Semi. As indicated on Tesla's website, we anticipate the Tesla Semi to require less than 2 kWh per mile of range[4], which, holding all else equal, would further reduce the assumed battery size. Tesla also finds the 35% buffer needlessly conservative. To the degree ARB is generally assuming widespread charging infrastructure, the size of the buffer can also be presumably be reduced.

Energy Costs

In developing the assumed energy rates for BEVs in CA, ARB chose not to include reduced demand charges implemented in Southern California Edison's service territory on the grounds that including these demand charge discounts would increase the complexity of the analysis. Additionally, the study observes that the demand charge discount is being phased out in 2029, well before the end of the overall study timeframe. It's not clear from the report how much of a difference this decision makes to the TCO values, but on its face, it seems problematic and at cross-purposes with other efforts in the state to deliberately exclude this from a cost-effectiveness analysis. The discount was implemented pursuant to direction from California Public Utilities Commission (CPUC) with the specific goal of supporting the economics of electrification. Additionally, it would not be unreasonable to assume that policies like this will get extended. In fact, SCE has indicated its intent to extend its current policy and to continue to work with customers on appropriate commercial EV rate options.[5] Tesla encourages ARB to modify the cost study to not only include the demand charge discount that is currently in place but to

[3] "Tesla 'Battery Day' Promises 56% Reduction In Battery Cost And Much More", Brad Templeton, September 22, 2020; https://www.forbes.com/sites/bradtempleton/2020/09/22/tesla-battery-day-promises-56-reduction-in-battery-cost-and-much-more/?sh=7739cc786253

[4] https://www.tesla.com/semi

[5] In its Application, SCE proposes to "extend the current energy-only rate structure design established by D.18-05-040 for TOU-EV-8 and TOU-EV-910 until new rate proposals are developed under Transportation Electrification Framework (TEF) guidance as part of a RDW or stand-alone proceeding in the future."

also run a sensitivity analysis that assumes extension of this policy or future alternatives with similar intent in SCE's territory as well as those of the other IOUs given the directive in the CPUC's Transportation Electrification Framework proceeding that rates continue to be an important economic driver for transportation electrification investments.

Low Carbon Fuel Standard Credit Value (LCFS)

As modeled, the value of LCFS credits appears to assume that the carbon intensity (CI) curve which ultimately drives the value of LCFS credits would remain unchanged from the current regulation over the duration of the study period. This would explain why the LCFS value is assumed to drop so precipitously through 2045. However, Tesla believes it would be reasonable to assume that the state will take action to reset the CI schedule to make it more stringent over the timeframe being evaluated by the cost study. Given the state's net zero by 2045 target, it would seem appropriate to include a scenario where this curve is reset to require a CI of 0 by 2045. This would put significant upward pressure on LCFS prices.

Additionally, it is not clear if ARB, in developing its estimate of LCFS credit value, included CARB polices that allow for entities to claim low-CI energy by matching electricity used for transportation with renewable energy credits (RECs) registered with the Western Renewable Energy Generation Information System (WREGIS). This matching appropriately allows electricity that is sourced from a renewable resource and used as a transportation fuel to be treated as zero emission for purposes of LCFS credit generation, unlocking additional credit value. ARB should clarify if its analysis reflects this in its LCFS credit value projections and, if not, modify its analysis to ensure this additional value is reflected in the cost effectiveness assessment.

Infrastructure Costs

Tesla asks ARB to clarify whether the infrastructure costs identified in the report BEVs includes costs associated with infrastructure on the utility side of the meter. With the passage and implementation of Assembly Bill 841, investments by the utility in distribution infrastructure on the utility side of the meter to support EV charging are to be recovered from the general body of ratepayers.[6] As a result of this policy, and for purposes of the TCO analysis, only those costs associated with the infrastructure deployed on the customer side of the meter should be included in the TCO study.

Tesla also asks that ARB recognize the impacts of the various EV charging infrastructure programs that are being pursued by the CPUC and Energy Commission. These programs are providing hundreds of millions of dollars to support the deployment of MD and HD charging infrastructure, including direct subsidies to defray the cost of EV infrastructure on the customer side of the meter. For instance, the Energy Commission recently released an updated budget for Clean Transportation Program investments, which, while still subject to further modification, would include at least $70 million in funding over the next 3 years for MD/HD charging infrastructure equipment.[7] Furthermore, the IOUs each have significant funding programs to cover MD/HD infrastructure including on the customer side of the meter with SCE's program budgeted at $343 million and PG&E at $236 million. These programs are expected to be available for the next 5 years. As currently conceived, we understand ARB chose not to include these incentives in its infrastructure cost estimates. Similar to our concern discussed above regarding

[6] See CPUC Resolution E-5167;
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M405/K054/405054570.PDF
[7] FY 2021-2022 revised staff report on Clean Transportation Program Funds.

the exclusion of SCE's demand charge wavier/discount from the assumed electricity costs used in the TCO analysis, excluding these programs from the TCO study appears at cross purposes with, and to essentially ignore, the efforts of other agencies in this area. The point of these programs is to reduce the infrastructure costs that end-users must bear and thereby support the economics of transportation electrification. To ignore these policies in the TCO analysis does a disservice to these efforts.

The deadline for meeting a 100% ZEV sales requirement should be moved to 2035.

Tesla strongly supports ARB's efforts to establish a stringent sales requirement on manufacturers of MD and HD vehicles and applauds ARB staff for pushing this further by proposing to modify the Advanced Clean Truck regulation to include a 100% sales requirement. Given the gravity of the climate crisis including the fact that the impacts of climate change appear to be manifesting sooner and with greater severity than anyone has anticipated[8], coupled with ARB's cost study which shows that zero emission vehicles across the spectrum of MD and HD vehicles will be cost effective sometime between 2025 and 2030, Tesla believes there is a strong case for accelerating the 100% sales mandate to 2035 if not earlier. Such an acceleration can also help further address some of the concerns expressed by stakeholders that are subject to the ACF regulation that there may be insufficient supply to meet the demand for ZEVs that the ACF creates. This mandate would also provide the appropriate signal to manufacturers that they need to entirely shift to ZEVs and double down on current efforts. As indicated on CALSTART's Zero-Emission Technology Inventory, across vehicle categories there appears to be growing representation of incumbent and new manufacturers pursuing ZEVs, with an increasing number of models available or in the pipeline. However, given the scale of the transition that is required, it is reasonable for ARB to push for accelerated action to drive manufacturer product roadmaps more emphatically and quickly toward ZEVs.

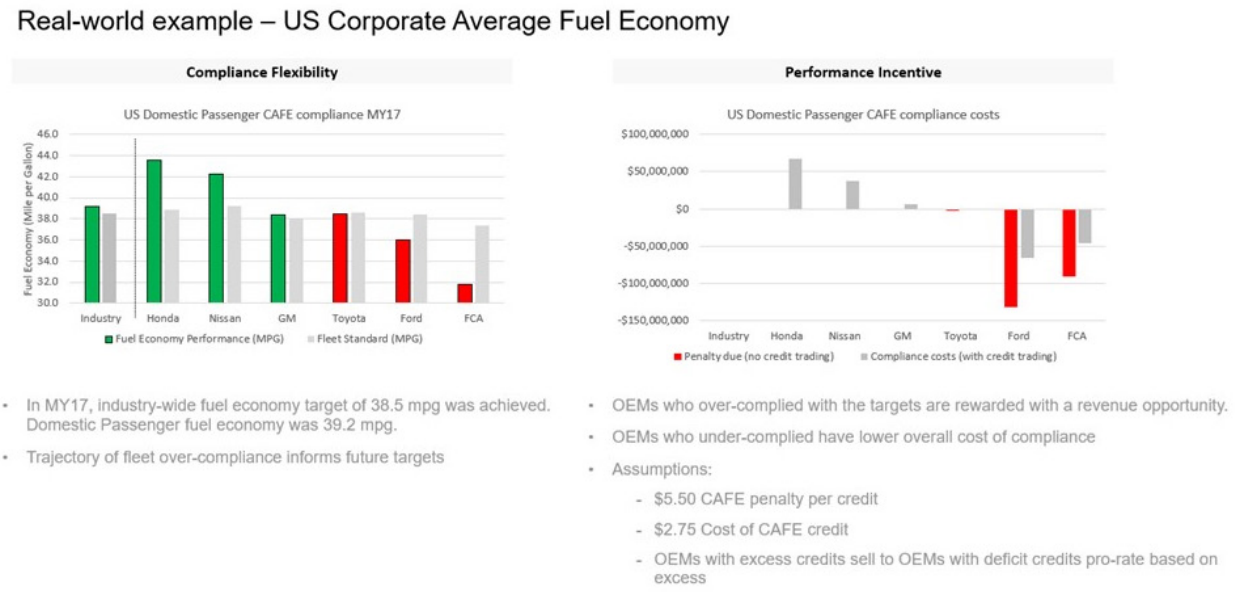
Opportunities to generate, bank and trade excess compliance should be incorporated into the regulatory framework for high priority and federal fleets.

The current draft regulation as applied to high priority and federal fleets does not contemplate enabling entities to generate, bank and trade compliance credits. Tesla sees this as a significant missed opportunity to encourage early action, drive compliance above the minimum floors set in the regulation, and to reduce the overall costs of the policy on the market and society. Particularly in the case of the high priority and federal fleets, crediting, banking and trading provisions would seem to offer substantial value given the tremendous diversity of fleets covered by the framework and therefore the significant variability in the costs to comply that different obligated entities will face. In these circumstances, allowing entities that face lower costs to comply to, in effect, over-comply, and sell that overcompliance to entities that are more challenged can reduce the overall compliance cost and improve the economic efficiency of the regulation. Additionally, such a framework can encourage overcompliance. For example, it would create opportunities for entities that do not have a compliance obligation (e.g., fleet

[8] "The West is Burning, Climate Change is Making it Worse", Cameron Peters, Vox, July 25, 2021, https://www.vox.com/2021/7/25/22592004/wildfires-climate-change-reconciliation-bill; "Study: Northwest heat wave impossible without climate change", Seth Bornstein, OPB, July 7, 2021, https://www.opb.org/article/2021/07/07/study-northwest-heat-wave-impossible-without-climate-change/; Climate Change Indicators in the United States, US Environmental Protection Agency, https://www.epa.gov/climate-indicators; "Climate change indicators and impacts worsened in 2020", April 19, 2020, https://public.wmo.int/en/media/press-release/climate-change-indicators-and-impacts-worsened-2020;

owners/operators with less than the threshold number of vehicles that would make them subject to the framework) to sell compliance credits into the regime, therefore supporting the economics of electrification and encouraging them to move to a zero-emission fleet more quickly than they might otherwise. Similarly, for entities with a compliance obligation, the opportunity to sell compliance credits into the framework can motivate them to purchase and deploy ZEVs in excess of the floors set by the regulation.

An example of the benefits a crediting framework can provide to support efforts to reduce the environmental impacts of the transportation sector can be seen in the experience with the US Corporate Average Fuel Economy regulation. As shown in the graphs below, the ability of entities to sell excess compliance credits to other obligated entities resulted in the overall market exceeding the CAFE standard's fuel efficiency target. From a cost standpoint, this also provides a means for those entities with deficits to reduce their exposure to penalties that they would have otherwise been subject to, thereby reducing the overall costs of the program to obligated entities.



Further, ARB has already recognized the benefits of credit generation, banking and trading regimes by including them within a number of different regulatory frameworks related to transportation, including the Low Carbon Fuel Standard and the Advanced Clean Trucks Regulation. Further, as observed by the U.S. Environmental Protection Agency, "Averaging, banking, and trading (ABT) provisions have been an important part of many mobile source programs under the Clean Air Act. These provisions help manufacturers in planning and implementing a phase-in of emissions reduction technology in their production that is consistent with their unique redesign schedules. As part of the GHG program, ABT provisions allow manufacturers to average their car or truck fleet CO2 emissions (i.e., the standards do not apply to individual vehicles), to earn and "bank" credits by reducing their car or truck fleet performance to below the applicable standards, and to trade credits between manufacturers. EPA believes the net effect of the ABT provisions is that they allow additional flexibility, encourage earlier introduction of emission reduction technologies than might otherwise occur, and do so without

reducing the overall effectiveness of the program."[9] While the specifics of the regulations referenced above vary, many, if not all, of the same rationales for including the flexibility these crediting regimes afford would seems to apply to the Advanced Clean Fleet Rule.

In proposing this Tesla is mindful of the critical importance of structuring any such crediting regime in a manner that does not adversely impact the efficacy of the rule in reducing emissions associated with the operation of MD and HD fleets and in particular ensuring that the opportunity to generate and use credits does not result in reduced deployment of ZEVs in those communities that bear a disproportionate share of the pollution burden associated with the operation of MD and HD vehicles. To that end, Tesla believes there are various options that ARB might consider should it move forward with incorporating credit generation and trading into the framework for high priority and federal fleets. For example, ARB could establish limits on the extent to which entities with compliance obligations can meet those obligations utilizing compliance credits procured from other entities. This could take the form of a fixed percentage amount (e.g., in any year no more than 40% of an entity's compliance obligation pursuant to the ACF can be met through the retirement of compliance credits purchased from another entity) or by constraining the extent to which a compliance obligation associated with a given vehicle type can be met using credits procured from another entity (e.g. the compliance obligations associated with day cabs in an entity's fleet cannot be met using compliance credits procured from other entities).

Tesla would also recommend limiting the ability to generate tradeable credits to pure ZEVs given the relatively lower environmental/pollution benefits NZEVs offer.

In Attachment 1 to these comments, Tesla provides proposed edits to the draft ACF regulation for high priority and federal fleets to include credit generation, trading and banking provisions.

Tesla thanks ARB staff for the work that has gone into the draft regulations and cost study as well as for the opportunity to submit these comments. We look forward to future discussions with staff and the other stakeholders in this proceeding as ARB continues to refine this important body of regulation and associated materials.

/s/ Andy Schwartz
Andy Schwartz
Senior Managing Policy Advisor
Tesla, Inc.
901 Page Avenue
Fremont CA, 94538
Tel: 510-410-0882
Email: anschwartz@tesla.com

[9] United States Environmental Protection Agency, The 2020 EPA Automotive Trends Report Greenhouse Gas Emissions, Fuel Economy, and Technology since 1975 (January 2021) pg. 74 https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010U68.pdf

Attachment 1 – Proposed Edits and Additions ACF Proposed Draft Regulation – High Priority and Federal Fleets

95692.3 Advanced Clean Fleets Credit Generation, Banking, and Trading

a. ZEV Credit Calculation. Notwithstanding whether a fleet owner operator has a compliance obligation pursuant to this regulation, a fleet owner/operator may generate compliance credits for each ZEV or NZEV operating in its fleet in a given year, provided the vehicles fall within the vehicle types included in Group 1, Group 2 or Group 3 pursuant to Table A above. The credits generated for each ZEV in service in a given fleet represents one vehicle-year of compliance value.
b. Credit Banking. ZEV and NZEV credits may be banked for future use. Banked credits may be used to satisfy compliance deficits under this regulation for up to ten years from the year the credit was generated.
c. Credit Trading and Transfer. ZEV credits may be traded, sold, or otherwise transferred between fleet owner/operators. ZEV credits transferred in this manner may be used to satisfy deficits and have limited lifetimes as established per the above. NZEV credits cannot be transferred to other entities and therefore cannot be used by other entities to meet their compliance obligations.
d. Limited Credit Lifetime. ZEV and NZEV credits have a limited lifetime of ten years from the year within which they were generated. For example, ZEV credits generated in 2022 may be used to meet compliance requirements through 2032 but may not be used to meet compliance obligations in 2033 or thereafter.

Section 95692.~~3~~4 High Priority and Federal Fleets Compliance Demonstration

(a) Annual Compliance Determination. For each year that a fleet owner/operator has compliance obligation, compliance is achieved when the number of ZEV or NZEV credits an obligated fleet owner/operator retires offsets their compliance deficits as calculated pursuant to 95692.1.
(b) Any compliance deficit associated with a day cab or sleeper cab must be offset with credits generated by vehicles put into service in the obligated fleet owner/operator's fleet. These deficits cannot be offset by credits procured from other entities. However, nothing forecloses entities using purchased credits generated from the deployment of ZEV day cab or sleeper cabs to offset deficits associated other vehicle types/categories.
(c) Requirement to Make Up a Deficit. A fleet owner/operator that retires fewer ZEV or NZEV credits than required to meet its credit obligation in a given compliance year is subject to the requirements of 95692.1(g).
(d) Compliance Certificate. If the requirements of sections 95692 through 95692.6 have been met and the required reporting has been received to demonstrate compliance, CARB will provide the fleet with a Certificate of Reported Compliance.