April 12, 2018

Shirin Barfjani
Air Pollution Specialist, Mobile Source Control Division
California Air Resources Board
1001 I Street, P.O. Box 2815
Sacramento, CA 95812-2815

Re: Innovative Clean Transit Regulation Concept

Submitted online via CARB's Web Comment Submittal Form

Dear Ms. Barfjani:

We, the undersigned members of the Advanced Clean Transit (ACT) Coalition Partners, appreciate the opportunity to provide comments on the ICT Regulation Concept Paper from the California Air Resources Board (CARB) dated March 27, 2018. Overall, our coalition has come together under the recognition that our climate and air pollution problems in California are so severe that we need robust regulations to shift all types of vehicles to zero-emissions. Advancing zero-emission buses provides a critical anchor to this work, and we encourage staff to bring a final regulation to the Board for approval as soon as possible that achieves the following two critical goals: 1) ensures all of California's buses are zero-emission by 2040 and 2) uses a purchase mandate as a vital mechanism to ensure this transition.

Regulation Starting Date

We would not oppose shifting the starting date beyond 2020 for the purchase mandate. Even though our climate and air quality problems require swift action to eliminate tailpipe pollution,

we believe that many of the objectives of the regulation – namely achieving more widespread deployment of zero-emission buses – could occur even if the fleet purchase requirement begins in 2023.

Importantly, our openness to a delayed start date is not intended to signal that transit agencies should wait until that date to begin procuring zero-emission buses (ZEBs). On the contrary, for the more than 50 percent of transit agencies with more than 50 buses that already have ZEBs in revenue service or have them on order, the later start date will permit them to continue moving forward aggressively, accommodate their unique procurement schedules and still take full advantage of available HVIP, VW mitigation and other funding sources to help pay for their rapid transition to ZEBs. But, the purchase mandate provides an important signal that transit agencies should start purchasing 100 percent ZEBs as their old buses need replacement in order to bank credits that could apply towards meeting the 2023 and future purchase requirement milestones.

We also support a requirement that all transit agencies submit Board-approved ZEB Transition Plans to CARB by no later than December 31, 2020. The plans should indicate how the agencies will transition to 100 percent ZEB no later than (and hopefully much earlier than) 2040. The process of creating these plans will aid transit providers in understanding how feasible it is to begin this process in earnest to reduce costs by taking advantage of incentive programs and get to lower operating costs sooner than if they were to delay action and incur higher costs of transition.

We also recommend that the rule be structured so that 33 percent of new bus purchases must be ZEBs beginning January 1, 2023, 66 percent beginning January 1, 2025 and 100 percent beginning January 1, 2027. There is broad agreement that the most common life of a transit bus is 14 years. Thus, to achieve a fleet transition by 2040, non-ZEB purchases should end by 2027.

Role of Incentives

While the difference between the cost of a combustion bus and an electric bus continues to decline, there currently remains a significant cost difference in the up-front purchase of zero-emission buses. HVIP, VW mitigation funds and other programs are designed to substantially cover these incremental capital costs especially in the early years of this transition. By shifting the purchase requirement date to 2023, those agencies that purchase ZEBs prior to that date or that purchase a higher percentage of buses than required in 2023 and later milestone dates, will be able to take advantage of these incentive funds.

Overall Cost

We look forward to reviewing CARB Staff's document summarizing the key assumptions and outcome of its Total-Cost-of-Ownership (TCO) model. This document has the potential to provide transparency and enable transit agencies to develop a level of comfort with the model and results. The CARB TCO study will be important in informing the plans we recommend transit agencies submit to CARB by the end of 2020.

CARB's total cost of ownership results presented at its June 26, 2017 ICT workshop are well-reasoned and are consistent with the results of other analyses. In October 2017, the UC Davis Institute of Transportation Studies (ITS) released its timely and seminal paper entitled, "Exploring the Costs of Electrification for California's Transit Agencies."[1] This analysis used conservative assumptions but still concluded that:

> *"When these [California's Hybrid Vehicle Incentive Program (HVIP) and Low Carbon Fuel Standard (LCFS)] incentives are included, the cost of electrifying the entire fleet in the current period is not statistically different from business as usual costs", and that [o]ver time, electric buses are expected to deliver lower operating costs and lower lifetime costs compared to conventional powertrains."*

The California Transit Association (CTA), until recently, has put out significantly overstated transition cost numbers based on erroneous assumptions. When these erroneous assumptions are corrected, the CTA results are not significantly different than CARB's. Please see attached **Appendix A** which discusses these assumptions. Recently, in a letter to the California State Legislature dated March 22, 2018 the CTA noted:

> *"Additionally, these groups [Sierra Club, Earthjustice, Union of Concerned Scientists and the American Lung Association] recently shared with us that they believe there are errors in our cost model - these concerns are being taken seriously and we are updating our cost estimates, as appropriate."*

Further it should be noted that many significant developments have occurred since the CARB, UC Davis and CTA cost studies were completed. These changes make the total cost of ownership even more favorable and will provide more up-front capital to cover the costs of paying for electric buses. These developments include:

a. HVIP funding has increased:
    i. The pool of available funding last year was $21.4 million and now it's $182 million with a carve out of at least $35 million for public transit buses. Thus, there is more HVIP funding just for transit buses than existed for all HVIP eligible vehicles (i.e., electric trucks, school buses and other vehicles).
    ii. The amount of the incentive per bus has increased. For the most common transit bus type, (40') the incentive increased from $95,000 to **$150,000 per bus** plus an additional $15,000 if the bus operates in a disadvantaged community.
    iii. A new incentive was created for 60' buses of **$175,000 per bus** plus $15,000 if operating in a disadvantaged community.

[1] UC Davis Institute of Transportation Studies, "Exploring the Costs of Electrification for California's Transit Agencies" [1](Hanjiro Ambrose, et al. Reference Number: UCD-ITS-RR-17-16. (Go to https://its.ucdavis.edu/research/publications/ and enter the title above in the search area to find this publication.).

iv. A new incentive was created to pay up to **$30,000 per bus charger**.

b. Under SB 350 (2015) the investor owned utilities (IOUs) have now filed applications to the California Public Utilities Commission (CPUC) requesting:
    i. To pay for the electrical infrastructure upgrades needed to the bus depots and the "make readies" (trenching and electric cabling from the depot meter to the charger pedestals). The CPUC has already approved funds for the SCE territory through the priority review program. In some cases, the IOUs are also providing rebates to help pay for the chargers as well.
    ii. More favorable tariffs for lower electricity costs for transit agencies and heavy-duty trucks.

    The CPUC is expected to rule on these as early as next month.

c. Improvements to the Low-Carbon Fuel Standard program are approaching. The current program provides significant financial support for ZEB fuel costs and can cover most, all or potentially even more than the annual cost of electricity for an electric bus, depending on charging protocols. Access to LCFS funds will not be restricted once the Innovative Clean Transit (ICT) standard is put in place. Further, CARB is currently moving through a process to update this program and is expected to finalize these changes this year. If proposed improvements are adopted, it could increase the amount of credits by 30 percent or more.

d. Bus ranges have increased. For example, New Flyer which holds 45 percent market share for transit buses of all types in North America, increased the range of its electric bus from 208 miles to 284 miles. Both Proterra and New Flyer now offer an option to add a second electric motor which allows the bus to go up very steep grades. When the second motor is added to the Proterra bus, its efficiency is improved and the maximum range of the bus increases from 350 miles to 424 miles.

Cutaways and Non-standard Buses

We agree that cutaway and non-standard buses (i.e., GVWR under 26,001 lbs) should be included in the ICT rule but not included in the initial implementation requirement at this time.

We recommend that CARB create a categorization structure for each of these types of buses and track developments in each category. Criteria that should be met within each category before including required purchase of these buses should include:

1. Buses must be commercially available.
2. The buses must be successfully Altoona tested and approved HVIP eligible.
3. CARB should conduct a total cost of ownership study for each of the major categories.

Once the above criteria have been met CARB could issue a draft supplemental component of the ICT standard along with the justification for meeting the criteria above. The proposed component should also take the form of a purchase mandate following a similar ramping up structure as used for buses already covered by the ICT standard. The standard for cutaway and non-standard buses should also result in complete transition to zero-emission technologies by 2040. The new component of the standard should provide at least two years lead time before the first purchase requirement. CARB should provide an opportunity for stakeholders to comment before implementing the new component.

Regulatory Assessment

We support the proposal to conduct a technology assessment which should occur in 2024, immediately after the first compliance date. We also look forward to considering other regulatory assessment proposals that may surface.

We appreciate all the work of CARB staff to make this standard a reality. These are exciting times where California can achieve the twin objective of advancing clean air and helping put people to work in the clean energy economy building zero-emission buses and fueling infrastructure. We look forward to continuing this collaboration on this incredibly important protection of public health.

Sincerely,

Ray Pingle
Lead Volunteer, CARB ZEB Rulemaking
Sierra Club California

Kathryn Phillips
Director
Sierra Club California

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Jobs to Move America

Bonnie Holmes-Gen
Senior Director, Air Quality and Climate Change
American Lung Association in California

Appendix A

March 5, 2018

California Air Resources Board, Members
1001 I Street
Sacramento, CA 95814

Sent via e-mail

RE: CTA's Erroneous Cost Study Regarding the Proposed Innovative Clean Transit (ICT) Regulation

Dear Chair Nichols and Members of the California Air Resources Board:

We have previously provided comments on the clean transit rule. However, recently, the California Transit Association (CTA) has circulated erroneous information about the cost of the rule. Since the cost of change is a pivotal consideration on any discussion of such a significant transition, we wanted to provide these additional comments to highlight the facts about the anticipated cost of the rule.

In its letter to you dated January 22, 2018, CTA states that it believes there will be a "…required investment of $3.2 billion to $6.5 billion to achieve full electrification by 2040." CARB staff at the June 26, 2017 ICT workshop stated that the agency's carefully developed total-cost-of-ownership (TCO) model indicated there would actually be a savings of $.6 billion to accomplish this goal. Why such a large difference between the CTA and the CARB model?

Sierra Club representatives have been members and active participants in CARBs ICT Transit Bus Lifecycle Cost Modeling Subcommittee for over the last two years, working directly with CARB staff and representatives of the CTA and its member agencies. We are very familiar with both the CARB and the CTA's TCO models at a detailed level and with the assumptions they use. The CTA is to be commended for taking the lead in creating their first TCO model and beginning work on assumptions prior to CARB creating its model and their work informed and has been helpful in the development of CARB's model.

However, there are omissions and incorrect assumptions in the CTA model that lead to unreasonably high costs and a false conclusion. Following are the most important discrepancies in the CTA study:

1. **The $6.5 billion cost level is based on a faulty assumption and should be eliminated.** The $6.5 billion cost scenario assumes that each conventional bus will have to be replaced with 1.25 electric buses and that this will be true until 2040. The primary rationale for this is that electric bus ranges are not sufficient to meet route distance needs and so more buses are needed. This effectively increases the total cost of electric buses by 25%. This concept is a holdover from two years ago when the longest-range bus would only go 154 miles on a charge. CARB conducted a transit agency survey in 2016 that indicated that 56% of bus routes were less than 150 miles. Now that there are buses with ranges over 300 miles and bus makers are continually coming out with buses that have longer ranges, this replacement ratio is essentially no longer needed. This one assumption drives the full cost difference between the CTAs $3.2 billion cost and the $6.5 billion. The $6.5 billion amount should be removed completely leaving only the $3.2 billion cost number to discuss.

2. **CTA does not include any incentive funds** – The CARB model includes the value of Low Carbon Fuel Standard (LCFS) incentive credits in its model. The CTA model does not, and this is a significant omission that alone could reduce the cost in that model by $249 million.

   In October 2017, the UC Davis Institute of Transportation Studies (ITS) released its timely and seminal paper entitled, "Exploring the Costs of Electrification for California's Transit Agencies" [2]

   In the section on fuel costs, it states:

   > *"The LCFS credit for E-buses replacing conventional transit buses is $0.10-$0.14 per kWh of charging energy (the credit value fluctuates with the LCFS market). The LCFS credit can represent 100% or more of the electricity rate proposed by some utilities for over-night, managed charging. The LCFS credit value potentially reduces the fuel costs of E-buses to a few cents per-mile (Figure 4).*
   >
   > *LCFS is one of several state climate programs intended to improve the value proposition of low carbon alternatives, including Cap and Trade, which generates considerable funding for low carbon projects…. For these reasons, E-bus fuel subsidies are likely a secure source of funding for the expected life of vehicles."*

   Further it should be noted that neither model includes Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) or any other incentive funding. We recommend that were these models to be updated, they should include some HVIP incentive funding which would further improve the TCO results.

[2] UC Davis Institute of Transportation Studies, "Exploring the Costs of Electrification for California's Transit Agencies" [2](Hanjiro Ambrose, et al. Reference Number: UCD-ITS-RR-17-16. (Go to https://its.ucdavis.edu/research/publications/ and enter the title above in the search area to find this publication.).

3. **CTA's assumption for the cost of a CNG bus used in the "business as usual" scenario is too low.** The CTA uses $461,600 for a CNG bus. CARB uses $485,000 per bus which is the same amount used in the UC Davis ITS study referred to above. This difference reduces the cost of the business as usual case by 5%. In total, this one item reduces the $3.2 billion by $232 million. Actually, both models should increase this assumption by another $15,000 to at least $500,000 because most agencies are now buying CNG buses with low NOx engines. Were this change made it would make this have a $372 million impact on reducing the costs indicated in the CTA study.

4. **CTA Costs of electricity fuel are significantly too high**

    b. **The CTA's cost assumptions are more than twice CARBs**. CARB has created a "Battery Truck and Bus Charging Cost Calculator." to determine realistic electricity costs.[3] They have validated this model and the current commercial rate schedules it uses with utilities. CARB's weighted average cost for electricity from the state's five largest utilities, for electric buses that are charged at the bus depot is $.12/kWh. The CTA uses $.235/ kWh. This produces electricity fuel costs which are nearly twice CARBs value. We would invite anyone to review the cost calculator and take it to their utility for validation if needed. This error alone inaccurately increases electricity costs by nearly $1 billion ($996 million.) in the CTA Study.

    c. **CTA uses an incorrect electricity cost inflation assumption which further greatly increases the cost of electricity.** In our CARB Cost Committee, one set of assumptions we all agreed on was to use the Energy Information Administration's (EIA) "Annual Energy Outlook 2017" forecasts for fuel costs for diesel, CNG and electricity fuels. (This was the same source that the ITS study used as well.) Perhaps in order to contain the growing complexity of the model, the CTA used a more simplistic inflation factor method. But the result of this was to inflate the cost of electricity by 99% by 2040 while using the EIR table data inflates it only 30%. This error further increases the electricity cost error very substantially.

    d. <u>As noted above, the ITS study states: "*The LCFS credit value potentially reduces the fuel costs of E-buses to a few cents per-mile."*</u>

    e. **CTA misinterprets results of an NREL study.** As further evidence of the alleged high cost of electricity as a fuel, the CTA's letter cites an important NREL study[4] and states, "The Discussion Document similarly understates the cost of electricity as fuel, a key component of transit bus TCO. In the NREL study, the per mile cost for electricity was $0.41 per mile, compared to $0.25 per mile fuel cost for the CNG control fleet,…".

    However, this is a misleading statement in two ways.

    - First, the electricity cost they cite here is for atypical and more expensive **in-route fast charging**. It is widely acknowledged that

[3] (https://arb.ca.gov/msprog/ict/meeting/mt170626/170626chargecostcalcv3.xlsm)
[4] NREL Technical report 5400-67698 June 2017; https://www.nrel.gov/docs/fy17osti/67698.pdf

now with the availability of longer range buses, the clear majority of electric bus **charging will be done in bus depots** which is much less expensive.

- Secondly, **the CTA cited the raw data and not the corrected data** that NREL produces to make a fair comparison between the fuel costs for the CNG vs electric buses used in the study. The NREL report states:
  "The operating duty cycle of a bus has a significant effect on fuel economy. Because Foothill Transit operates its BEB and CNG bus fleets differently, the efficiency results presented above are not considered an apples-to-apples comparison."

When they corrected for the different routes that the CNG buses ran vs the electric buses, this

"…would increase the cost [for the CNG fuel] to an overall average of $0.50 per mile [vs the $.25/mile reported in the raw data], which is higher than the cost of the BEB fleet [$.41/kWh]."

So, the cost of electricity for the electric buses, even using higher cost fast charging, is 18% lower than the cost of fuel for the CNG buses.

5. **New developments, since these studies were done, can lead to even more positive TCO financial results.** CARB's study was last updated in June 2017 and the CTA's in April 2017. A lot has happened since then including:

e. HVIP funding has increased.
   i. The pool of available funding last year was $21.4 million and now it's $182 million with a carve out of at least $35 million for public transit buses. (The HVIP program also funds electric trucks, school buses and other transportation types.)
   ii. The amount of the incentives per bus have increased. For the most common transit bus type, (40') the incentive increased from $95,000 to **$150,000 per bus** plus an additional $15,000 if the bus runs in a disadvantaged community.
   iii. A new incentive was created for 60' buses of **$175,000 per bus** plus $15,000 if operating in a DAC
   iv. A new incentive was created to pay up to **$30,000 per bus charger**.

f. Under SB 350 (2015) the investor owned utilities (IOUs) have now filed applications to the CPUC requesting:
   v. To pay for the electrical infrastructure upgrades needed to the bus depots and the "make readies" (trenching and electric cabling from the depot meter to the charger pedestals). In some cases, the IOUs are also providing rebates to help pay for the chargers as well.
   vi. More favorable tariffs for lower electricity costs for transit agencies and heavy-duty trucks.

The CPUC is expected to rule on these in the next few months.

g. Bus ranges have increased. For example, New Flyer which holds 45% market share for transit buses of all types in North America, increased the range of its electric bus from 208 miles to 284 miles. Both Proterra and New Flyer now offer an option to add a second electric motor which allows the bus to go up very steep grades. When the second motor is added to the Proterra bus, its maximum range increases from 350 miles to 424.

h. The TCO will improve significantly with the addition of:
   vii. HVIP Incentive funding covering the majority of the cost difference between an electric bus and a CNG bus;
   viii. CPUC approval of utilities' request to pay for the cost of most of the charging infrastructure upgrade costs, especially when combined with the new HVIP incentive of $30,000 / charger; and
   ix. CPUC approval of utilities' request for more favorable rate schedules.

6. UC Davis ITS Study

This is a comprehensive, conservative and thoughtful study. It takes a snapshot look at costs in two periods. The Current Period (2016-2018) and in 2030. In the executive summary, it states:

"Agencies are also eligible for an additional $1 to $3.7 billion dollars in subsides from the California's Hybrid Vehicle Incentive Program (HVIP) and Low Carbon Fuel Standard (LCFS). When these incentives are included, the cost of electrifying the entire fleet in the ***current period*** *[emphasis added] is not statistically different from business as usual costs."*

Further, it states: "Conclusions: A transition to electric buses increases annual expenditures as new investments in infrastructure are made. ***Over time, electric buses are expected to deliver lower operating costs and lower lifetime costs compared to conventional powertrains.*** *[emphasis added]"*

Summary

The CTA significantly overstates estimated net costs for California's transit agencies to transition to all zero-emission buses by 2040. Were the CTA to update its assumptions to those we suggest above, the cost difference between the CTA study and CARB's would become small.

Based upon CARB's TCO model results, corroboration from the UC Davis ITS Study, and inclusion of the positive financial impact of new developments since these studies were done, we believe that the Total Cost of Ownership is no longer an obstacle for transitioning to a 100% ZEB fleet by no later than 2040.

Having said that, it will be important for CARB to design the mechanical structure of a purchase requirement rule such that the transit agencies have two years of lead time to plan and implement

their transition to ZEBs and to allow time for agencies to access incentives such as HVIP before the early compliance period.
HVIP is important because it is designed to pay for a majority of the cost difference between a CNG and electric bus, for example. It is expected that electric bus costs will continue to decline and could reach parity with fossil-fueled buses in a few years, thus reducing the need for incentive funds in the future.

Sincerely,

Kathryn Phillips
Director, Sierra Club California

Ray Pingle
Lead CARB ZEB Rule Project
Sierra Club California

cc:
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