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September 10, 2019

Board of L.A. Metro  
One Gateway Plaza  
Los Angeles, CA 90012-2952

**CHBC Comments on Metro Bus Fleet Forecast and Zero Emission Bus Program Update**

Dear Members of the L.A. Metro Board,

The California Hydrogen Business Council<sup>1</sup> has reviewed the Metro Board Report (File #:2019-0458) on the “Metro Bus Fleet Forecast and Zero Emission Bus Program Update” dated July 18, 2019.<sup>2</sup>

We would like to take this opportunity to offer comments and data related to the key issues addressed in the report and comparative data, which we believe is prudent for the Board to consider moving forward. It relates to financial burden to riders and the Metro in the path towards zero emissions and the admirable goal of eliminating the emissions of the LA Metro bus fleet and meeting the ICT regulation.

In summary, the key metrics presented in the report that we would like to discuss are:

- \$700M to \$1 billion estimated capital for charging infrastructure
- Unknown TCO for buses (utility and operating costs)
- Curb weight limits as an issue for range
- CNG buses outperforming ZEBs, possibly requiring more ZEB buses to cover same service level

The CHBC has previously submitted comment to the Board sharing concerns regarding a tendency at the agency to narrowly focus on battery electric technology for bus electrification, rather than also look at both zero emission technologies, batteries and hydrogen fuel cells. In earlier staff assessments, fuel cell electric buses were dismissed, despite their excellent record of 20 years of service in California.

Based on existing projects, we offer the following financial and performance related data for hydrogen fuel cell bus projects:

- The liquid hydrogen delivery approach for the new Orange County Transportation Authority (OCTA) fuel cell electric bus fleet is completely applicable to LA Metro’s transit bus fleet.

<sup>1</sup> The views expressed in these comments are those of the CHBC, and do not necessarily reflect the views of all of the individual CHBC member companies. CHBC Members are listed here: <https://www.californiahydrogen.org/aboutus/chbc-members/>

<sup>2</sup> <https://metro.legistar.com/View.ashx?M=F&ID=7540128&GUID=F5A4B938-A44C-4652-BAA6-EB7E5C66E081>

OCTA's fueling station infrastructure, developed by Trillium, is sized for a 50-bus fleet, with the total project costs of \$5.65 million for 50 buses amounting to \$113,000 per FCEB.<sup>3</sup> This includes 3 years of warranty and full maintenance. For better comparison, just capex with a standard 1-year warranty is closer to \$4 million.

- In addition, liquid hydrogen stations have great scaling characteristics. According to Trillium, with an additional investment of \$2 million at the start of the project at OCTA, the station could have supported 200 buses. A round \$7 million for 200 bus stations would equate to **\$35,000 of capex per fuel cell electric bus** for the infrastructure investment. This compares to LA Metro's low-end infrastructure estimate of \$700 million for 2,300 buses, which would be at least **\$304,000 per battery bus**, and even higher if only the 1,900 scheduled service buses are considered.
- Shell projects economical delivered cost for hydrogen supply of \$5/kg for fuel contracts of 10 tons/day (= 333 buses) or \$3/kg for 50 tons/day (=1,667 buses), excluding cost of the station. L.A. Metro would create such demand very quickly.
- According to a Bloomberg New Energy Finance analysis, hydrogen will play a growing role in reducing pollution and the cost of renewable hydrogen falling as low as \$1.40/kg by 2030.<sup>4</sup>
- We also reference our Fuel Cell Electric Bus factsheet, which outlines the performance of FCEBs, especially as a 1:1 zero emissions replacement for current diesel (or CNG) buses, which provide the same range, power, refueling time, and duty cycle.<sup>5</sup> An analysis by AC Transit from last year further indicates that today's FCEBs can replace 95% of their routes without compromise.<sup>6</sup> This was validated by AC Transit after conducting an in-service test with their new FCEB bus. L.A. Metro would thus not need to look into purchasing additional buses to maintain its current service with FCEBs.
- SunLine Transit has stated that for their FCEB in operation, "the total cost per mile is comparable to CNG buses we have in service"<sup>7</sup>. AC Transit reported that current fuel cost is at \$7.42 per kg of hydrogen (\$.60 more than diesel equivalent MPG). Their maintenance cost is at \$187,000 per year per fuel station.
- Bus manufacturer New Flyer projected in 2018 that fuel cell electric buses at volume of 100 bus purchase would cost \$850,000, with lower cost projected at even higher volumes, very similar to the cost of BEBs.
- While BEBs suffer from weight limitations due to the weight of their battery packs, they compensate by either having to reduce passenger capacity or exceeding weight limits at similar passenger capacities, fuel cell electric buses are similar in weight to diesel or CNG buses.

We request a meeting with the Board and staff to provide the data that we feel is needed for LA Metro to make an informed and cost effective decision about the deployment of its future electrified fleet.

Best,

  
Emanuel Wagner

Deputy Director

California Hydrogen Business Council

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<sup>3</sup> OCTA is sized for 1,500kg/day = 50 buses at 30kg per day

<sup>4</sup> <https://www.bloomberg.com/news/articles/2019-08-21/cost-of-hydrogen-from-renewables-to-plummet-next-decade-bnef>

<sup>5</sup> <https://www.californiahydrogen.org/wp-content/uploads/2017/10/CHBC-CaFCP-Fuel-Cell-Electric-Bus-Fact-Sheet.pdf>

<sup>6</sup> [http://www.actransit.org/wp-content/uploads/board\\_memos/18-134%20ZEB%20Assessment.pdf](http://www.actransit.org/wp-content/uploads/board_memos/18-134%20ZEB%20Assessment.pdf)

<sup>7</sup> <https://www.sustainable-bus.com/fuel-cell/el-dorado-national-fuel-cell-bus-ballard-completed-successfully-testing/>