

**RESPONSES TO BOARD REQUEST FOR ZEB PLANS 4/28/16**

During the April 28, 2016 Board meeting, staff was directed to report back and provide detailed updates on several items at the October 2016 Board of Directors meeting. Attached are technical responses to these questions, and supporting data is also attached to this report.

- A. **Greenhouse Gas Emission Reduction Options:** Metro's technical consultant, Ramboll/Environ, has provided a detailed assessment of options for reducing greenhouse gas emissions and for transitioning to ZEB's. Key recommendations from this analysis include focusing on using longer range ZE buses and immediately adopting the use of Low NOx "Near Zero" CNG engines and using RCNG for fueling. For certain corridors, such as Metro's Orange Line, there will be opportunities to use specialty ZEB's with en-route opportunity charging. Based on this technology assessment and state of ZE technologies in 2016, Ramboll/Environ does not recommend pursuing fuel cell buses at this time.
- B. **USA ZEB Transit Deployments:** As of April 2016, staff identified 57 transit agencies that are operating a total of 280 zero emission buses in the US.
- C. **Current ZEB Manufacturers:** Staff has identified five (5) major domestic US manufacturers that have produced heavy duty 40' or 60' zero emission buses for large transit agencies in the US: BYD; Proterra; Gillig; New Flyer; and Nova Bus (a subsidiary of Volvo). Of these manufacturers, BYD and Proterra solely produce electric buses; Gillig, New Flyer and Nova offer both electric buses as well as conventionally powered transit buses. In addition to these five manufacturers, there are several other smaller manufacturers that produce light and medium duty transit vehicles in a variety of configurations.
- D. **Additional Updates on Zero Emission Buses:**
1. Greenhouse gases and air pollutant levels. All the programs identified for Zero and Near Zero Emission propulsion systems have impacts on criteria pollutants and GHG emissions. The most cost effective option for emission reductions today is Near Zero CNG engines. Refer to Ramboll/Environ report.
  2. Noise levels (i.e. decibels): Attached is a comparison between conventional CNG and zero emission buses. Based on Altoona noise testing data, the average interior and exterior noise levels for Zero Emission buses are 4-8 dB lower than CNG buses.
  3. Partnering and Scalability: Production challenges and opportunities to partner with other agencies in large procurements to achieve economies of scale discounts; comparison of long-term maintenance costs.

Metro has identified over 50 transit operators who have initiated ZEB programs. No single US transit operator, even the largest operators like LA Metro, have the resources and means to single-handedly support ZEB commercialization. We have also surveyed the five

major US bus manufacturers who have produced heavy duty 40' and 60' buses and will pursue any opportunities to leverage Metro's ZEB investments. We will also continue to reach out to regional municipal transit operators and provide opportunities to partner with Metro on our upcoming bus procurements.

4. Chronological timeline of the advancements and forecasts in zero emission bus technologies; refer to Ramboll/Environ report.

- E. **Metro Routes Suitable for ZEB's** – Metro reviewed all lines and run assignments by operating division, and also looked at potential layover facilities to rank the best corridors for ZEB operation. Out of Metro's 1,900 weekly run assignments, 71% are under 150 miles, and 99% are under 250 miles; many of these lines may be suitable to battery electric buses. However, many of these runs also have extended run times; almost every operating division has run assignments where buses don't return to the home division for 20 hours or more.

The top rated corridor for ZEB's is the Metro Orange Line (MOL) BRT which currently operates 43 articulated buses. The MOL corridor has several advantages for operating ZEB's, including a dedicated right-of-way with no traffic and Metro-owned terminals at each end that can be used for en-route opportunity charging. Metro is also looking at other BRT services like the Silver Line that have similar operational characteristics and advantages for deploying ZEB's.

Attached is a line-by-line assessment of all Metro bus routes and operating divisions to help determine suitability for ZEB operation.

- F. **ZEB Funding Sources** – Attached is a listing of potential Federal, State and local funding sources that are eligible for the purchase of zero-emission bus vehicles.
- G. **ZEB Bus Procurements** – Recommendations from Metro's Board for costing ZE options and considering seating capacity have been included in the new bus solicitation that is currently underway. The full RFP can be found on-line on Metro's Vendor Portal ([here](#)). Staff will report back periodically on the status of these items when they return to the Board with recommendations for contract award(s) based on this solicitation.