

Zero-Emission Bus Rollout Plan

Section A: Transit Agency Information

City of Santa Monica's Big Blue Bus
1660 Seventh Street
Santa Monica, CA 90401

Big Blue Bus is part of South Coast Air Quality Management District (AQMD) and part of South Coast Air Basin.

Peak Vehicles: 162
Population: *(optional)*

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Big Blue Bus is not part of a
Joint Zero-Emission Bus Group.



Section B: Rollout Plan General Information

In 2016, the Santa Monica City Council adopted the Zero Carbon 2030 Fleet Plan and directed Big Blue Bus (BBB) to undertake a landmark process to convert its fleet to zero emission propulsion systems, ahead of the 2040 mandate. This plan directs the Big Blue Bus to buy 100% zero emission vehicles for its transit fleet allowing for a full transition to zero emissions without early retirement of vehicles. This plan is intended to be a living

document which is subject to change as zero emission bus technology and infrastructure mature.

The rollout plan was adopted by City Council on June 23, 2020. A copy of the resolution is included in appendix A.

For additional information on the rollout plan, please contact the following:

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Section C: Technology Portfolio

Big Blue Bus (BBB) is currently developing a Master Plan for zero-emission infrastructure. For the first phase, BBB is building electrical infrastructure to charge up to 25 battery electric buses. At a minimum, BBB will procure 19 battery electric transit vehicles. Future purchases will consider BBB’s operational needs and may include hydrogen-electric, and or battery electric buses.



Section D: Current Bus Fleet Composition and Future Bus Purchases

Big Blue Bus (BBB) currently has a fleet of 195 fixed route revenue vehicles consisting of 30-, 40-, and 60-foot articulated buses. The table 1 represent BBB’s current fleet.

Table1: Individual Bus Information

| <u># OF BUSES IN REVENUE SERVICE</u> | <u>MODEL YEAR</u> | <u>MAKE</u> | <u>MODEL</u> | <u>FUEL TYPE</u> | <u>BUS TYPE</u> | <u>Length</u> |
|--|-----------------------|-------------|--------------|------------------|-----------------|---------------|
| 9 | 2004 | NEW FLYER | L40LF | LNG | STANDARD | 40' |
| 9 | 2006 | NEW FLYER | L40LF | LNG | STANDARD | 40' |

| | | | | | | |
|----|------|-----------|-----------------|--------------------|-------------|-----|
| 5 | 2010 | EL DORADO | EZR II- BRT 32' | CNG | STANDARD | 30' |
| 10 | 2011 | EL DORADO | EZR II- BRT 32' | CNG | STANDARD | 30' |
| 21 | 2011 | NABI | 60BRT-14.02 | CNG | ARTICULATED | 60' |
| 9 | 2011 | NABI | 40LFW-14.01 | CNG | STANDARD | 40' |
| 1 | 2012 | GILLIG | G27D102N4 | CNG | STANDARD | 40' |
| 44 | 2013 | GILLIG | G27D102N4 | CNG | STANDARD | 40' |
| 13 | 2014 | GILLIG | G27D102N4 | CNG | STANDARD | 40' |
| 4 | 2015 | GILLIG | G27E102N2 | CNG | STANDARD | 40' |
| 11 | 2015 | GILLIG | G27D102N4 | CNG | STANDARD | 40' |
| 7 | 2015 | NEW FLYER | XN60 | CNG | ARTICULATED | 60' |
| 5 | 2016 | GILLIG | G27D102N4 | CNG | STANDARD | 40' |
| 19 | 2017 | GILLIG | G31D102N4 | CNG | STANDARD | 40' |
| 1 | 2017 | GILLIG | G27D102N4 | CNG | STANDARD | 40' |
| 19 | 2018 | GILLIG | G31D | CNG | STANDARD | 40' |
| 7 | 2018 | GILLIG | G31E | CNG | STANDARD | 30' |
| 1 | 2019 | GILLIG | G28D | ELECTRIC- DEPOT | STANDARD | 40' |

Per City Council direction, Big Blue Bus will only purchase zero-emission transit vehicles for replacement moving forward. No conventional buses (i.e. CNG, LNG, gasoline hybrid fueled vehicles) will be purchased. Table 2 represents the anticipated buses that will be purchased in the future.

Table2: Future Bus Purchases

| <u>Timeline (Year)</u> | <u>Total # of Buses to Purchase</u> | <u># of ZEB Purchase</u> | <u>% of Annual ZEB Purchase</u> | <u>ZEB Bus Type</u> | <u>ZEB Fuel Type</u> |
|------------------------|-------------------------------------|--------------------------|---------------------------------|---------------------|--------------------------|
| 2021 | 18 | 18 | 100% | Standard | Battery Electric – Depot |
| 2022 | 5 | 5 | 100% | Standard | Zero Emission Bus |
| 2023 | 10 | 10 | 100% | Standard | Zero Emission Bus |
| 2023 | 21 | 21 | 100% | Articulated | Zero Emission Bus |
| 2023 | 9 | 9 | 100% | Standard | Zero Emission Bus |
| 2025 | 45 | 45 | 100% | Standard | Zero Emission Bus |
| 2026 | 13 | 13 | 100% | Standard | Zero Emission Bus |
| 2027 | 15 | 15 | 100% | Standard | Zero Emission Bus |
| 2027 | 7 | 7 | 100% | Articulated | Zero Emission Bus |
| 2028 | 5 | 5 | 100% | Standard | Zero Emission Bus |
| 2029 | 20 | 20 | 100% | Standard | Zero Emission Bus |

| | | | | | |
|------|----|----|------|----------|--------------------------|
| 2030 | 19 | 19 | 100% | Standard | Zero Emission Bus |
| 2030 | 7 | 7 | 100% | Standard | Battery Electric – Depot |

Big Blue Bus will replace its fleet of transit buses with zero emission vehicles on a one-for-one basis as they reach the end of their useful life. This replacement schedule is subject to change as BBB periodically adjusts its service levels in response to rider demand. BBB is technology agnostic and is considering battery electric buses and hydrogen fuel cell buses to meet its zero emission goals.

Table 3 represents the required operational range for future zero-emission buses to serve BBB’s fleet and its estimated cost.

Table 3: Range and Estimated Costs of Future ZEB Purchases

| <u>Timeline (Year)</u> | <u>Total # of Buses to Purchase</u> | <u>ZEB Bus Type</u> | <u>Required BEB Range</u> | <u>Estimated Cost of Each Bus</u> |
|------------------------|-------------------------------------|---------------------|---------------------------|-----------------------------------|
| 2021 | 18 | Standard | 140 | \$890,000 |
| 2022 | 5 | Standard | 200 | \$890,000 |
| 2023 | 10 | Standard | 200 | \$890,000 |
| 2023 | 21 | Articulated* | 200 | |
| 2023 | 9 | Standard | 200 | \$890,000 |
| 2025 | 45 | Standard | 200 | \$890,000 |
| 2026 | 13 | Standard | 200 | \$890,000 |
| 2027 | 15 | Standard | 200 | \$890,000 |
| 2027 | 7 | Articulated* | 200 | |
| 2028 | 5 | Standard | 200 | \$890,000 |
| 2029 | 20 | Standard | 200 | \$890,000 |
| 2030 | 19 | Standard | 200 | \$890,000 |
| 2030 | 7 | Standard | 200 | \$890,000 |

**the estimated cost of an articulated bus is unknown at this time.*

While our conventional buses are equipped with near zero engines, these buses will not be converted to zero-emission. Big Blue Bus will purchase zero-emission vehicles for replacement of buses per the timeline above.

Section E: Facilities and Infrastructure Modifications

Big Blue Bus will modify its yard and maintenance facility to accommodate the transition to zero-emission. BBB operates one facility located at 1620 6th Street in Santa Monica and as such all facility upgrades or modifications will take place at that facility. Below is a table of the infrastructure modifications, Big Blue Bus would undergo, per the Master Plan.

Table 4: Facilities Information and Construction Timeline

| <u>Project Phase</u> | <u>Phase Timeline</u> | <u>Type(s) of Infrastructure</u> | <u>Facility Service Capacity</u> | <u>Needs Upgrade</u> |
|----------------------|-----------------------|--|----------------------------------|----------------------|
| Phase 1 | Present - 2021 | Long-term analysis ZEB options, Installation of SCE vault containing transformers and panels, and conduit and wiring for charging capacity up to 25 buses | 19 buses | Yes |
| Phase 2 | 2021 - 2023 | Upgrade electrical vault to add additional transformers, and installation of electric bus chargers. SCE to evaluate BBB's energy supply needs based on latest available charging technology. | 64 buses | Yes |
| Phase 3 | 2023 - 2026 | Additional vault or substation, or hydrogen fueling system, as required by long-term plan, additional electric bus chargers | 122 buses | Yes |
| Phase 4 | 2026 - 2029 | Upgrade of infrastructure per long-term plan | 169 buses | Yes |
| Phase 5 | 2029 - 2030 | Upgrade of infrastructure per long-term plan | 195 buses | Yes |

BBB's electrical service is provided by Southern California Edison (SCE). BBB successfully pursued SCE's Charge Ready Transportation grant program. The grant will be for Battery Electric Bus (BEB) charging of up to 25 buses and consists of installation of an electrical vault containing a transformer that can power up to 25 battery chargers, electrical panel and cable wiring stubbed to the charger end locations. Construction and commissioning of the SCE infrastructure should be completed by March 2021.

BBB will utilize smart charging infrastructure to balance charging loads over time reducing the peak energy demand for electric bus charging. Staff is also exploring all

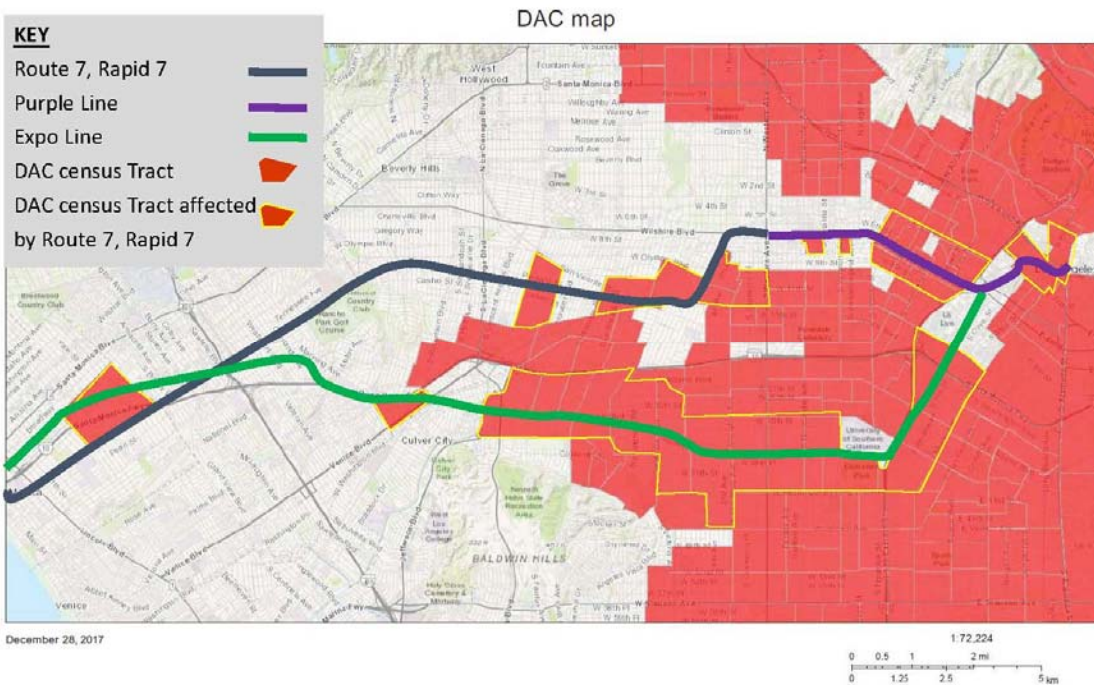
zero emission vehicle options to determine how to best utilize emerging technologies to meet BBB’s operational needs. Future infrastructure may include hydrogen fueling capacity or in-route charging infrastructure based on the results of the zero-emission vehicle master plan.

Section F: Providing Service in Disadvantaged Communities

The City of Santa Monica’s Big Blue Bus (BBB) provides service to approximately 13 million passengers annually in an urban service area of 58 square miles, located on the Westside of Los Angeles. In addition to the City of Santa Monica, BBB serves the Westside communities of Pacific Palisades, West Los Angeles, Brentwood, Westwood, University of California Los Angeles (UCLA), Cheviot Hills, South Robertson, Mid-City Wilshire, Westchester, Marina del Rey, Koreatown, Downtown LA, Venice and Playa Vista.

BBB routes provide regional connections to the Los Angeles International Airport (LAX), Union Station in downtown Los Angeles, Los Angeles County Metropolitan Transportation Authority (LACMTA) Rail systems at 13 stations, as well as Metrolink and Amtrak inter-city rail services.

The figure below demonstrates Route 7 and Rapid 7 that primarily serve the disadvantaged communities, but also allows for first-last mile connectivity to Metro rail.



Source: SB 535 Disadvantaged Communities CalEnviroScreen 3.0

All buses in the fleet are rotated throughout the system on a daily basis to meet FTA's Title VI requirements. As replacements buses or zero-emission buses are introduced into the fleet, the buses would be rotated throughout the system.

Section G: Workforce Training



The Big Blue Bus Safety and Training Division dynamically delivers training to ensure Motor Coach Operators, Transit Mechanics, Motor Coach Cleaners, and Facility Maintenance staff are at the top of innovative bus technology.

Motor Coach Operators receive four (4) hours of Battery Electric Bus familiarization, behind the wheel, and High Voltage system safety

training.

Motor Coach Cleaners receive Battery Electric Bus familiarization, High Voltage system Safety, behind the wheel, and Personal Protective equipment training. Including first responders and charging infrastructure training.

Transit Mechanics attend and complete two phases of comprehensive training prior to engaging in servicing or repairing of Zero-Emission buses;

- **Phase one** - Transit Mechanics must complete 8 hours of Digital Volt Ohm Meter, Electrical I, and Electrical II administered by Big Blue Bus Certified Instructors and Southern California Regional Transit Training Consortium (SCRITC).
- **Phase two** - Transit Mechanics must complete 24 hours of Zero-Emission Bus Technical Training, charging infrastructure, and 24 hours of Arc Flash Electrical Safety National Fire Protection Association (NFPA) 70E with Skills certification as listed in the Big Blue Bus Electrical Safety Work plan.

Concurrently, Facility Maintenance Staff must complete Zero-Emission bus familiarization, High Voltage system safety, charging infrastructure training, and must attend and complete 24 hours of Arc Flash Electrical Safety NFPA 70E with skills certification. Training to include electrical vault training, panels, and transformers as listed in the Big Blue Bus Electrical Safety Work Plan.

In addition, the Big Blue Bus Safety and Training division works with local governing agencies and deliver train the trainer sessions for First Responders including fire department and police department staff. First responders training comprise familiarization, energy storage systems, and emergency shutdown procedures.

Table 5: Training Schedule

| <u>Timeline (Year)</u> | <u># of ZEB purchase</u> | <u># of Mechanics Trained</u> | <u># of bus Operators Trained</u> | <u># Motor Coach Cleaners Trained</u> | <u># of Facilities Technicians trained</u> |
|------------------------|--------------------------|-------------------------------|-----------------------------------|---------------------------------------|--|
| 2021 | 18 | 18 | 316 | 19 | 5 |
| 2022 | 5 | 46 | 316 | 19 | 5 |
| 2023 | 10 | 46 | 316 | 19 | 5 |
| 2023 | 21 | 46 | 316 | 19 | 5 |
| 2023 | 9 | 46 | 316 | 19 | 5 |
| 2025 | 45 | 46 | 316 | 19 | 5 |
| 2026 | 13 | 46 | 316 | 19 | 5 |
| 2027 | 15 | 46 | 316 | 19 | 5 |
| 2027 | 7 | 46 | 316 | 19 | 5 |
| 2028 | 5 | 46 | 316 | 19 | 5 |
| 2029 | 20 | 46 | 316 | 19 | 5 |
| 2030 | 7 | 46 | 316 | 19 | 5 |

Section H: Potential Funding Sources

Big Blue Bus (BBB) has actively been seeking State and Federal funds to procure replacement buses with zero-emission technologies. Currently, BBB receives a formula allocated Urbanized Area Formula Funds from Federal Transit Administration (FTA) Section 5307. This covers at a minimum 80% of the zero-emission transit vehicle. Local funds are a combination of the State’s Transit and Intercity Rail Capital Program (TIRCP) and SB1 State of Good Repair funds.

BBB successfully pursued Southern California Edison’s (SCE) Charge Ready Transportation grant program. The grant will be for Battery Electric Bus (BEB) charging of up to 25 buses and consists of installation of an electrical vault containing a transformer that can power up to 25 battery chargers, electrical panel and cable wiring stubbed to the charger end locations. Construction and commissioning of the SCE infrastructure should be completed by March 2021.

BBB will continue to pursue additional funding sources, such as Carl Moyer, VW Settlement, HVIP, etc.

Additional funding may be available.

Section I: Start-up and Scale-up Challenges

- 1) Big Blue Bus has experienced some startup challenges including funding and the developing nature of zero emission bus technology. We have found the price of zero emission buses to be about \$200,000 more than our previous purchases of CNG buses not accounting for the added cost of purchasing and installing charging infrastructure. Another challenge was the nature of the technology. Because this industry is relatively new, companies have created buses with unique or proprietary operation and charging methods. This often means that agencies are limited by the manufacturer in what charging systems they can procure. There is also a limited pool of equipment manufactures for charging systems. The industry is not yet mature leading to a small pool of systems that support fast charging for heavy-duty applications. Several promising systems are awaiting certification.
 - a. Additional funding or tax exemptions for zero emission bus and charging system purchases could help close the funding gap in the transition to zero emissions. CARB could help push the industry to adopt standardized charging interfaces to provide more flexibility to transit agencies.
- 2) There are significant unknowns related to the cost of energy going forward that represent a financial risk to BBB as it looks to transition its fleet to 100% zero emissions technology. Current funding opportunities focus on providing funding for the purchase and installation of equipment, but no funding exists to offset any increase in the operating energy costs that would result from an electric bus fleet. BBB has also found that current electric bus ranges are insufficient to replace CNG buses one-for-one. Using current technology, wide scale deployment of zero emission vehicles would require an increase in fleet size, changes to bus scheduling, on-route charging, and/or moving toward hydrogen fuel cell technology. Each of these options carry their own risks and challenges that will likely require additional funding to resolve.

Appendix A

Resolution/Council Approval

DRAFT