



Board Report

File #: 2023-0766, **File Type:** Informational Report

Agenda Number: 31.

OPERATIONS, SAFETY, AND CUSTOMER EXPERIENCE COMMITTEE APRIL 18, 2024

SUBJECT: ZERO-EMISSION BUS PROGRAM UPDATE

ACTION: RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE status report on the Zero-Emission Bus (ZEB) Program.

ISSUE

In 2018, The California Air Resources Board's (CARB) Innovative Clean Transit (ICT) regulation mandated that all transit agencies in the state operate all-zero emission fleets by 2040. In addition, ICT ZEB purchase requirements for large transit agencies require 25% of bus purchases to be zero-emission beginning in 2023, 50% beginning in 2026, and 100% beginning in 2029.

In July 2017, Metro's Board of Directors approved Motion #50 by Directors Bonin, Garcetti, Najarian, Hahn, and Solis (Attachment A), which endorsed a ZEB Strategic Plan (SP) to transition the entire bus fleet to ZE by 2030, contingent on envisioned cost and performance equivalence with compressed natural gas (CNG) buses and continued advancements in charging infrastructure. As a result, Metro is the largest transit agency in the State with the largest investment in transition from CNG to ZE. The Motion has enabled Metro to meet all of the ICT ZEB purchase requirements 10 years ahead of schedule.

However, cost and performance parity have yet to materialize, and it is not projected to reach it for the foreseeable future. Furthermore, the recent pandemic adversely impacted the financial viability and competitiveness of the US clean bus manufacturing market. This, and other factors, recently led an OEM to announce plans to close its US manufacturing facility in 2025, another OEM to file for bankruptcy relief, and another OEM to close its manufacturing facility in Southern California - all within the last 12 months. The US now finds itself with just two major OEMs that can compete for Metro bus procurements.

BACKGROUND

Since the Board's actions in 2017, Metro has embarked on the most extensive ZEB transition program in the U.S. In 2018, Metro initiated the development of a comprehensive plan of action to guide the ZE transition. The "2022 Zero-Emission Bus Program Master Plan" was developed with

service analysis, design criteria, and action-ready requests for proposals (RFPs) to begin the transition of Metro's fleet to ZEBs.

To date, Metro has made significant progress in transitioning to ZEB service.

- Metro's G (Orange) Line bus rapid transit (BRT) initiated 100% ZE service at the start of 2021. To date, these vehicles have accumulated over three million miles of ZE service, the most miles by any public transit agency in the country.
- Conversion of Metro's J (Silver) Line BRT is underway and is anticipated to be completed by mid-2025.
 - Harbor Gateway opportunity charger installation work: 3 chargers installed out of 8 chargers.
 - El Monte Transit Center opportunity chargers & Division 9 Full electrification: Bids are due 04/05/2024.
- Division 18 & Division 7 Full electrification: RFP will be released in July with award planned for January 2025
- Metro is initiating a pilot program of approximately 20 buses to explore hydrogen fuel cell bus technology and the application in LA County's service environment.

Procurements:

- In September 2019, Metro awarded its final option for CNG buses and committed to all future procurements being ZE - a decade earlier than the ICT ZEB deadline of 2029.
- A total of 145 BEBs have been ordered, one of the most significant BEB procurements to date in California and among the three most significant in the country. Currently, 50 BEBs have been delivered, with the remaining 95 scheduled to be delivered between March and September 2024. Metro is projected to have the most BEBs in active service in the U.S upon delivery of these buses.
- In January 2023, the Metro Board authorized the solicitation of a Request for Proposal (RFP) of 260 additional BEBs and associated charging infrastructure, with up to four options of 200 BEBs each. The RFP will be released by May 2024.

Workforce Development:

- Metro has made significant investments in workforce development, developing a manufacturing careers policy and implemented advanced training for operators and maintainers specific to BEB technology.

Funding & Grant Applications:

- Metro has aggressively pursued all available ZEB-related federal and state grant funding, having applied for approximately \$741 million and successfully secured \$446 million to-date, inclusive of \$155 million in local funding, including one of the largest Low-Emission/No-Emission (LoNo) grants in this federal program's history (\$104.1 million awarded in 2022).
- Securing grant funding is challenging as the main criteria for all ZE grants is demonstrating GHG reductions. As Metro operates highly clean buses fueled with Renewable CNG, it is disadvantaged against agencies who have not pursued cleaner options and are still operating diesel buses.

-
- The grants will pay for Zero Emission Buses, charging infrastructure, and workforce development.
 - In the last 12 months Metro has applied for numerous grants including: FTA -LoNo, SCAG-CMAQ/STBG/CRP, and EPA-CPRG.
 - Scheduling project delivery is critical to ensure it aligns with grant draw-down requirements.

While aggressive program achievements and collaboration with relevant international and national organizations have incentivized the market to make investments in battery technology, energy management, and motor efficiencies, transit bus OEMs continue to leave the U.S. market including Nova Bus, Proterra, and ENC. Additionally, despite the progress made to date, significant challenges remain as the ZEB industry is still evolving and not sufficiently mature to allow for full implementation without risk to service. Key issues include cost and funding, vehicle performance, early obsolescence, utility lead times, and supply chain issues. Each is discussed below.

DISCUSSION

ZEB Costs and Funding

BEB cost and technical parity with CNG buses have not materialized. For example, per current contract prices from the states of California and Washington, the cost of a BEB 40-footer is almost double that of a CNG 40-foot bus. For 60-footers, the cost differential is 70.1% more. ZEBs are more expensive than CNG buses, and the new infrastructure required to support ZEBs requires a large initial capital investment.

The following are the areas of note regarding cost comparisons between ZEB and CNG buses:

- **Capital Costs**
 - This cost differential for ZEBs has dropped slower than initially expected.
 - The capital costs for installing BEB charging infrastructure at the depots and on-route charging are approximately \$600 million to \$800 million higher than the periodic cost of replacing CNG infrastructure.
 - Although Metro has successfully obtained more than \$400 million in additional grant funding for the ZEB program, more must be obtained or other Metro capital programs re-scheduled in order to complete the full transition to ZEB operation.
- **Operating Costs**
 - Costs to maintain and operate ZEBs are still being evaluated. From initial deployments, savings in maintenance costs have only now begun to be realized in some agencies. However, energy costs have not remained stable.
 - Costs to maintain and operate charging infrastructure can be higher than conventional CNG storage and fueling infrastructure, although many agencies are mitigating cost increases through external vendor contracts and extended warranties on the charging equipment, covered under capital expenditures.
 - Costs associated with charge management are still being developed; however, these costs will also be new costs over that of the CNG legacy fleet.

BEB Performance Challenges

- **Range** - Current BEBs have an operable range of 150-160 miles (dependent on a myriad of factors, such as seasonal fluctuations in energy usage, operator driving habits, route topography, general traffic speeds, etc.). Metro's updated service modeling analysis estimated future BEB battery capacities, and derived energy consumption rates to project the service blocks that can be completed by a single BEB on a single charge. Currently, 64% of Metro's 1,800 service blocks are within 150 miles. The model projected that up to 27% of the service blocks could not be completed with a fully charged battery pack by BEBs Metro will have purchased by 2030. In comparison, this situation is reduced to only 8% non-completion with BEB technology Metro expects to acquire between 2030 and 2035.
- **Reliability** - The industry is still gaining experience in integrating new technologies into existing systems. Metro continues to experience integration issues between new and existing battery systems and interfaces between the bus and charging infrastructure, leading to premature failures of components. Recent reports suggest that this continues to be an industry-wide problem and not unique to Metro's operation. Extending the transition period will allow technology to mature, improving fleet availability and reducing the time and resources required to maintain the fleet in a State of Good Repair (SGR).
- **Maintainability** - While the industry has focused primarily on ensuring ZEBs can perform as CNG counterparts, less effort has been made to develop diagnostic information and tools for on-site technicians to expeditiously investigate and repair failures. Because the technology is relatively new and rapidly evolving, agencies must resort to relying on OEM suppliers' subject matter experts who are remotely located to investigate and mitigate failures, leading to longer out of service times. Metro has taken on additional consulting staff to address these issues and recently received a \$5 million training grant for workforce development. The recent LoNo grant from the federal government can also be used to improve operator and maintenance staff training. Additionally, Metro's work to establish a Center for Transportation Excellence for advanced transportation technology is also designed to address these issues by incentivizing suppliers to locate their technical staff in Southern California.
- **Operability** - BEBs are relatively less user-friendly to operate compared to Metro's legacy fleet. As such, operators of BEBs need to be more intentional with driving. For example, operators will need to consider regenerative braking, HVAC usage, and buses' state of charge. Additional training and experience are needed to ensure the operators' familiarity with correct procedures to avoid creating faulty conditions.
- **Obsolescence** - As technology advances, parts, models, and other seemingly new equipment are rapidly becoming replaced - and in some cases, obsolete - as vendors continue to evolve their products and respond to market needs. As a result, vendors have less incentive to support early technology than their newest offerings.

Utility, Infrastructure, and Supply Chain Challenges

- Long lead times for grid upgrades - According to discussions with relevant staff of the electric utilities serving Metro's bus divisions, the project time that the utilities need to perform service studies, develop engineering and design documents, as well as add the necessary construction contractor time, is a core factor in achieving the transition at each division. It was identified that a minimum of four to five years is required to complete utility upgrades. Furthermore, should substation or transmission infrastructure upgrades be needed, the project time could be up to seven years.
- Grid capacity - Studies conducted by the California Independent System Operator (CAISO) have shown that the entirety of the California electrical grid is undersized by 2-3 terawatts (TW) and not ready to support a large-scale adoption of ZE vehicles. Additionally, more refined surveys of the divisions have revealed that the available grid capacity to serve some of its divisions may be less than the assumed minimum of five additional megawatts needed for each division. These challenges will require added efforts in the planning and design processes to mitigate and may result in schedule impacts.

Market availability - Supply chain issues and constraints are currently impacting the timelines to deliver ZEBs and their supporting infrastructure. These issues are worse for FCEBs than for BEBs, as the market is still not mature enough to support Metro's goals. Only two OEMs produce FCEBs, and only 4% of all ZEBs (procured or in operation) are FCEBs.

Considerations

Metro's bus fleet contributes only 0.2% of LA County transport emissions.

Over the last year, Metro has continued to engage with SCE and DWP. Specifically, Metro is taking advantage of the SCE Charge Ready Program and Chair Bass and Director Yaroslavsky's offices have facilitated meetings with DWP and Metro staff to improve communication and understanding of Metro's future utility needs.

APTA Bus Task Force

Labor market tumult, hyperinflation in material and component prices, commodity shortages, hardships by many parts suppliers, and the significant increase in the cost of capital, have undermined the financial health of the bus OEMs. Preserving, protecting, and nurturing a highly competitive US bus manufacturing market and the capacity to transition to zero-emission buses are essential. In October 2023, APTA created a Bus Manufacturing Task Force to recommend immediate actions that can support a more competitive and stable bus manufacturing capacity in the US.

State and Regional Collaboration

- Working with Los Angeles County Municipal Operators Association (LACMOA) in developing a ZEB joint procurement. This procurement will allow LA Metro and LACMOA to purchase hydrogen fuel cell buses, battery electric buses, opportunity chargers, and depot chargers.
- LA Metro and LACMOA are considering potential combined procurement for as many as 300 BEBs and fuel cell electric buses (FCEB) and for more than 1,300 ZEBs over the next seven

years. Vehicle and charging equipment specifications were distributed to municipal operators for review and feedback in March.

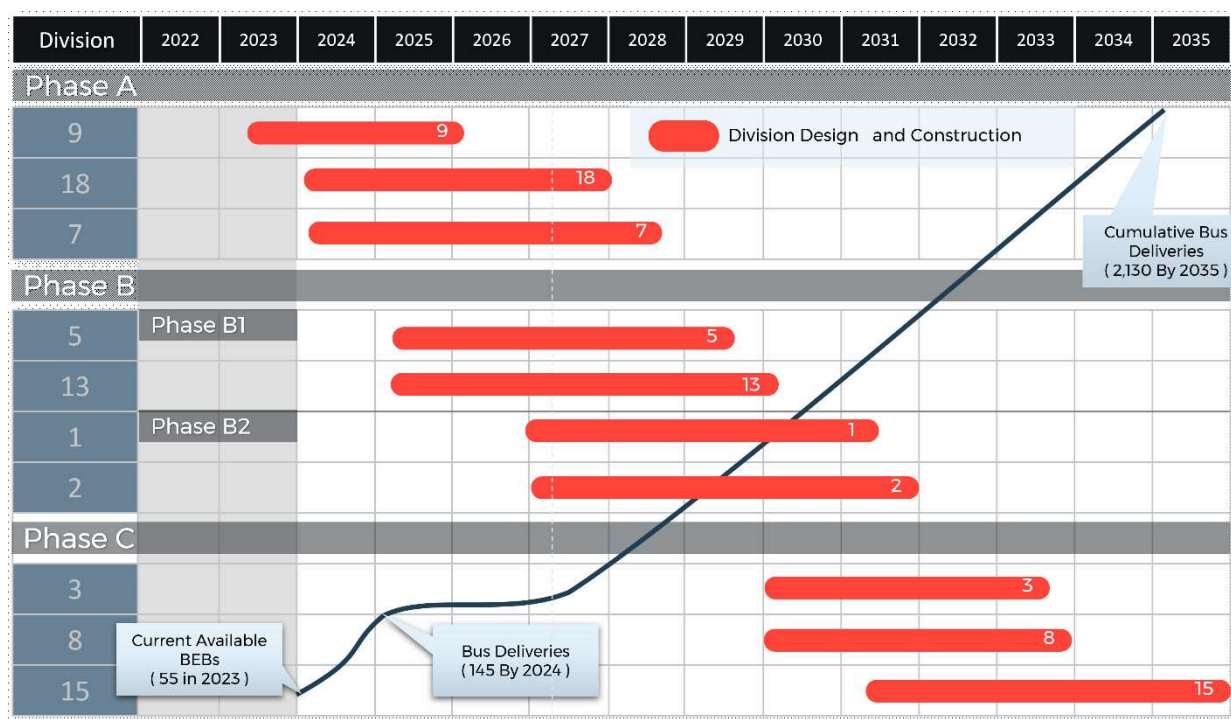
Current ZEB Conversion Schedule

The following updated phasing timeline for the continuation of the ZEB program is designed to maximize the potential gains from BEB technology growth while accommodating the extended timeline required for utility coordination.

- Phase 1 includes Divisions 7, 9, and 18, which are all serviced by SCE. Combining them in one phase allows for potential time savings with the related utility coordination and upgrades, particularly considering that such work has already commenced for Divisions 9 and 18.
- Phase 2 will focus on divisions serviced by LADWP, with most service blocks within 150 miles, which are divisions with service less dependent on on-route changing facilities. Phase 2 is further divided into two sub-phases as Divisions 1 and 2 have been identified with site-related constraints.
 - Phase 2A: D5 & D13
 - Phase 2B: D1 & D2
- Phase 3 includes Divisions 3, 8, and 15, where more of the bus network's longer service blocks are currently deployed, indicating the more extensive need for power and on-route chargers. Grouping them in the last phase will also benefit the most from potential advancement in BEB technology and range.

Moreover, the optimized infrastructure phasing schedule is consistent with the new bus procurement and charger installation schedules, SGR planning, and the staff's capacity to receive and make ready the new BEB and associated systems for service.

The following Gantt chart shows the phasing and transition schedule, by bus division, as well as the new BEB deliveries schedule based on updated procurement timelines:
However, staff continues to explore other opportunities to advance ZEB conversion, including hydrogen.



DETERMINATION OF SAFETY IMPACT

This update has no impact on safety.

EQUITY PLATFORM

No changes in equity-associated impacts are expected in the previously submitted board reports associated with the ZEB transition program. Maintaining service reliability and operability with the proposed program extension, as noted above, will allow Metro to continue to provide transit service for travelers throughout Los Angeles County with the fewest mobility options. BEBs will operate on routes restructured through the NextGen transit service plan. Seven out of the 10 Metro directly-operated bus divisions are located within a state-classified disadvantaged community (DAC) according to the California Environmental Protection Agency and in the established California Senate Bill 535. A DAC is defined as a community located in one of the top 25% highest-scoring census tracts identified by the CalEnviroScreen health screening tool. At least 50% of the communities serviced by lines from each division are DACs.

IMPLEMENTATION OF STRATEGIC PLAN GOALS

This update supports Goal #3 (enhance communities and lives through mobility and access to opportunity) and Goal #4 (Transform LA County through regional collaboration and national leadership). The revised implementation schedule also fulfills Metro's ZEB Strategic Plan goals in a manner consistent with considerations that minimize cost and operational risks to Metro's existing capital and operation plans.

NEXT STEPS

Staff will continue to proceed with a competitively negotiated solicitation for acquiring new ZEBs and supporting charging and fueling infrastructure, forecast to be released by May 2024.

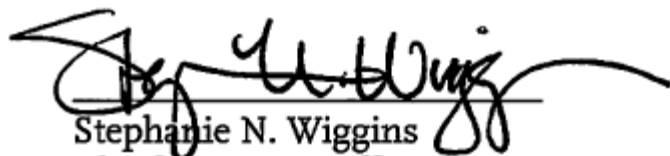
ATTACHMENTS

Attachment A - Board Motion 50 Strategic Plan for Metro's Transition to Zero Emission Buses

Prepared by: Jesus Montes, Senior Executive Officer, Vehicle Engineering & Acquisitions, (213) 418-3277

Matthew Dake, Deputy Chief Operations Officer, Vehicle Maintenance & Engineering, (213) 922-4061

Reviewed by: Conan Cheung, Chief Operations Officer, (213) 418-3034



Stephanie N. Wiggins
Chief Executive Officer



Metro

Board Report

File #: 2017-0524, File Type: Motion / Motion ResponseAgenda Number: 50

REVISED
REGULAR BOARD MEETING
JULY 27, 2017

Motion by:

**DIRECTORS BONIN, GARCETTI, NAJARIAN, HAHN and SOLIS
AS AMENDED BY SOLIS, KUEHL and BARGER****FRIENDLY AMENDMENT BY FASANA**

July 27, 2017

Strategic Plan for Metro's Transition to Zero Emission Buses

LA Metro has developed a comprehensive plan to deliver a complete transition to zero emission electric buses by 2030. The transition plan is contingent on two primary factors: continuous advancements in electric bus technology (which must increase range, reduce bus weights, reduce charging times, extend battery life cycles), as well as a drop in prices as the technology develops.

As electric bus technology continues to advance, our electric grid is becoming cleaner by gradually eliminating coal from our energy portfolio and replacing it with renewable sources. A full transition to electric buses coupled with renewable energy sources promises mobility with significantly lower environmental impacts from this form of transportation.

In order to maintain our bus fleet in a state of good repair, Metro plans to continue replacing its aging bus fleet at approximately 200 buses per year. With firm local hiring requirements in Metro bus procurement, routine bus procurement presents a recurring opportunity that bolsters our local labor force in perpetuity.

In 2012, Metro's U.S. Employment Plan resulted in the award of an \$890 million contract to Kinkisharyo, a factory in Los Angeles County, and 404 quality railcar manufacturing jobs. Similarly, Metro can leverage recurring bus replacements to bolster labor throughout Los Angeles County

Metro plans to spend nearly one billion dollars on bus procurements in the next ten years. That level of investment, coupled with a transition to all electric buses, presents an opportunity for LA County to demonstrate leadership on combating climate change, and can make Los Angeles the central marketplace for new electric bus technology: a County rich with quality manufacturing jobs rooted in technologies that provide mobility, sustain a healthy environment and create career paths in clean

File #: 2017-0524, File Type: Motion / Motion ResponseAgenda Number: 50

energy technologies.

**SUBJECT: MOTION BY BONIN, GARCETTI, NAJARIAN, HAHN
AND SOLIS AS AMENDED BY SOLIS, KUEHL AND
BARGER**

RECOMMENDATION

WE THEREFORE MOVE that the Board:

- A. ENDORSE the Strategic Plan for Metro's Transition to Zero Emission Buses;
- B. DIRECT the CEO to create a zero emission bus infrastructure working group comprised of Metro staff, federal and state regulators and local utility companies to track market availability and to cultivate ongoing collaboration among stakeholders. The working group will monitor market rates for emerging zero emission bus technology to support Metro's 2030 transition plan:
 - 1. Working group to report to the Board annually with the latest technology innovations to support the cost/benefit analysis of fleet conversion
 - 2. MTA to host an industry forum to solicit innovative solutions to delivering the 2030 plan;
- C. AMEND the Metro federal legislative plan to advocate for local jobs as a critical factor in the evaluation criteria of MTA procurements; and
- D. DEVELOP an equity threshold consistent with Title VI regulations for priority deployment of electric buses in underserved communities.

FURTHER MOVE that the Board direct staff to:

- A. As part of establishing a working group:
 - 1. EXPAND the invitation to regional air quality regulators (e.g. South Coast Air Quality Management District), the American Public Transportation Association and California Transit;
 - 2. EXAMINE and TRACK vehicle technology and performance, energy production and pricing, infrastructure needs and life-cycle analysis and creative funding opportunities.
- B. COORDINATE with the County of Los Angeles to explore opportunities to develop a countywide incentive structure to promote and attract more companies to manufacture, assemble and produce zero-emission transit vehicles and related technologies and infrastructure in Los Angeles County;
- C. Widely PROMOTE and ENCOURAGE municipal transit agencies/operators to participate in the established process by which to co-procure ("piggyback procurement" provisions) zero-

emission transit vehicles;

- D. ENSURE that MTA maintains the flexibility to explore the best available technologies that contributes to zero-emissions and/or net-negative emissions in the Los Angeles County public transit sector.

FRIENDLY AMENDMENT BY FASANA that staff report back to the board with a timeline and any commitments by parties before we undertake our next bus purchase and answers to the following questions:

- A. Will electric buses and their batteries deliver the guaranteed range and service?
- B. Can municipal and electric utilities timely invest in the grid in order to power electric buses?
- C. Which strategies will maximize Metro's ability to receive cap and trade credits?
- D. How and when can charging infrastructure be deployed at our bus divisions? More importantly, how will such infrastructure be paid for?
- E. Why is Metro's role critical for the adoption of low NOX engines in the trucking industry? What assurances do we have that this will take place when Metro has operated cleaner engines since the 1990s without adoption of these technologies by the trucking industry?
- F. What are the resiliency impacts to our service if electricity or natural gas service is disrupted? What is our back-up plan?
- G. Metro can intervene in regulatory proceedings at the California Public Utilities Commission for investor owned utilities regarding transportation electrification and equivalent natural gas proceedings as appropriate. Metro needs to assess the current regulatory schedule for such proceedings, develop advocacy position, and indicate that our adoption of electrification may be affected if electric transportation infrastructure is funded by shareholders, recovered through rates, and implemented on a timely basis.
- H. Conversely, how will Metro undertake the capital investments directly? Foothill Transit has intervened in the active proceeding. Antelope Valley and other providers are engaged. Metro needs to be more actively engaged and needs to report back to our Board on what is at stake. In SCE's service area, demand charges make the operating costs of electric buses more costly than natural gas vehicles. Are we working to influence changes to the rate schedules?
- I. Can RNG be adopted without direct Metro involvement by substituting RNG for natural gas purchased out of state? We should participate in any state framework that could create linkages between Metro's adoption of RNG and RNG implementation by the trucking industry.



Zero Emission Bus (ZEB) Program Update



Metro

**Operations, Safety, and Customer Experience Committee
April 18, 2024**

Progress Made to Date



July 2017

Metro's Board of Directors endorsed a ZEB Strategic Plan to transition the entire bus fleet to ZE by 2030

2018

Compliance with California Air Resources Board's (CARB) Innovative Clean Transit (ICT) regulation mandates: two milestones achieved

- Publication of ZE Rollout Plan – Completed
- 100% of Bus Procurements be ZE beginning 2029; Metro started July 2022

2016-2019

ZEB Procurements/Workforce Development – RFPs issued and contracts awarded for 145 BEBs

2017-2020

Transition to Renewal Natural Gas (RNG) completed October 2020

2021

Electrification of the G Line (Orange) completed

2021

Electrification of D9, HGTC, and EMTC initiated

2024

Funding Opportunities – Secured \$446M, inclusive of \$155M in local funding, to date

On-going

- Electrification of J Line (Silver)
- Conversions of SCE Divisions: D7, D9, & D18
- Workforce Development and Training
- Procurement of 1000+ ZEBs
- Aggressively pursuing additional funding opportunities

2023 ZEB Master Plan Update



2022 ZEB Master Plan

- Two phased approach
 - Phase 1: Electrification of the two BRT routes
 - Phase 2: Electrification of the remaining bus services
- More static service modeling approach without technology growth projections.
- Operating landscape and market conditions have changed.

2023 ZEB Master Plan

- Evaluated three program phasing options with electrification targets in 2030, 2035, and 2040.
- Updated Metro bus service data to reflect post-COVID conditions, including NextGen Bus Plan recommendations.
- Refreshed vehicle data based on the most recent Metro fleet inventory.
- Included a comprehensive service modeling and on-route charging analysis, considering projected BEB technology growth and procurement timelines.
- Updated the utility and power needs at each division.
- Revision of program cost projections according to the updated division phasing schedule.
- Additional evaluations conducted regarding contractor-operated divisions, power simulations, and backup power analysis.

Acknowledging Challenges



BEB Performance

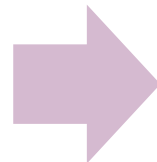
- Range
- Reliability
- Maintainability
- Operability
- Obsolescence

Utility, Infrastructure, & Supply Chain

- Long lead time for grid upgrades
- Grid capacity
- Market availability

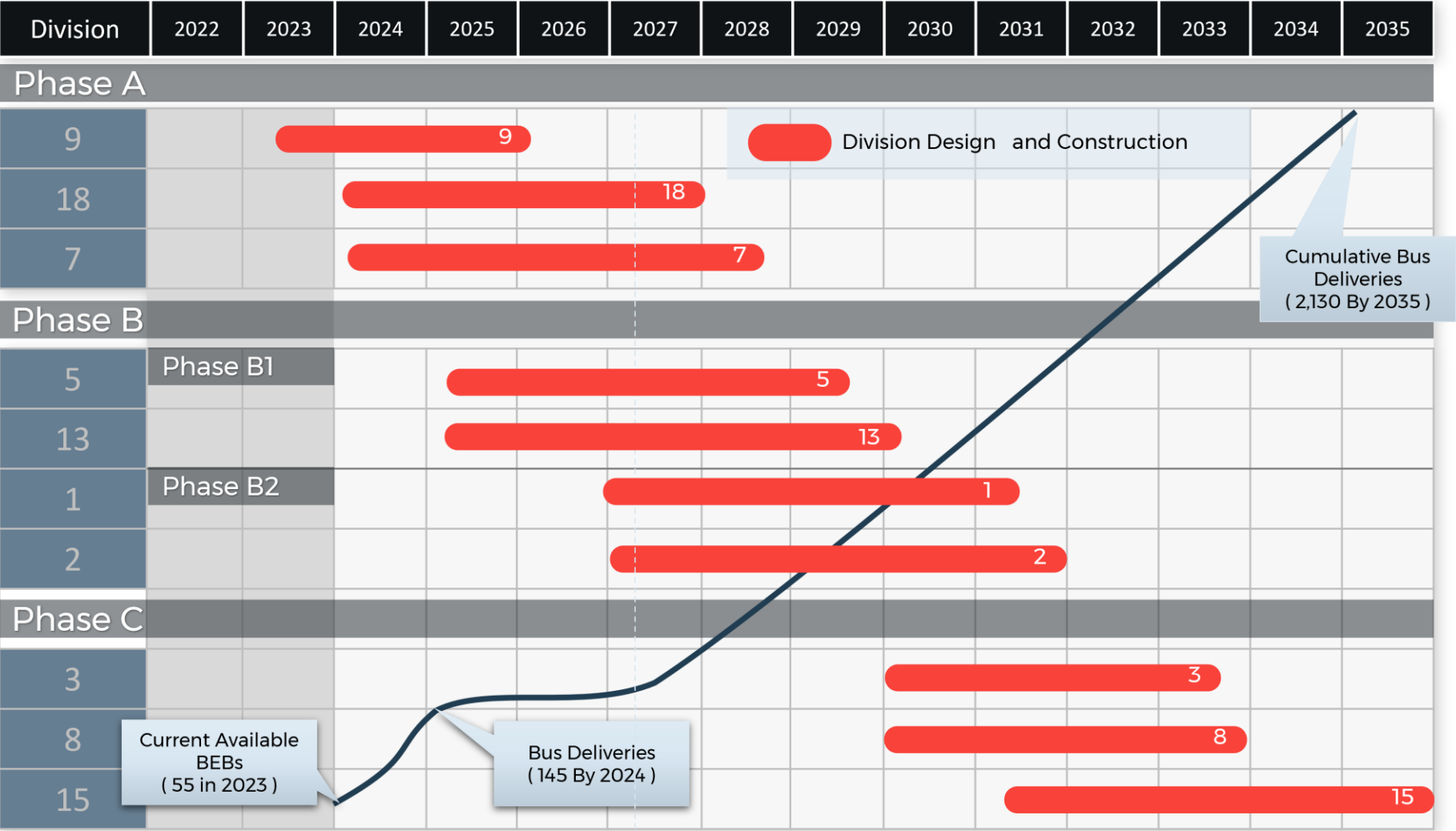
Costs

- ZEB continues to cost more to purchase than CNG buses
- Charging infrastructure costs are still significant
- Operating costs of BEBs have been high with initial deployments.
- The 2030 target requires an estimated \$675 million in annual cash flow.
- Extending the target to 2035 would reduce annual cash flow requirements by \$294 million between 2024 – 2030



Need to reconsider transition timeline and the division phasing schedule

Revised ZEB Program Phasing Schedule



THANK YOU





Zero Emission Bus (ZEB) Program Update



Metro®

April 25, 2024

ZEB Environmental Benefits



- LA Metro is committed to reducing regional carbon pollution and using clean fuel sources to power our bus fleet.
- While Metro's bus fleet contributes only 0.2% of LA County transport emissions, transitioning to ZEB is an impactful strategy for reducing emissions, especially as local utilities also transition to a carbon-free grid power.
- 45 ZEB buses are in service. Remaining buses use renewable natural gas (RNG), equipped with ultra-low NOx engines, which emit 90% less NOx than that allowed by EPA emissions standards.
- While Metro faces significant cost and service-related challenges as we transition the fleet, staff recognizes the urgency of improving air quality and reducing carbon emissions and remains committed to being a local and national leader in zero emission technology.



GHG Reduction by Vehicle Replacement (BEB)

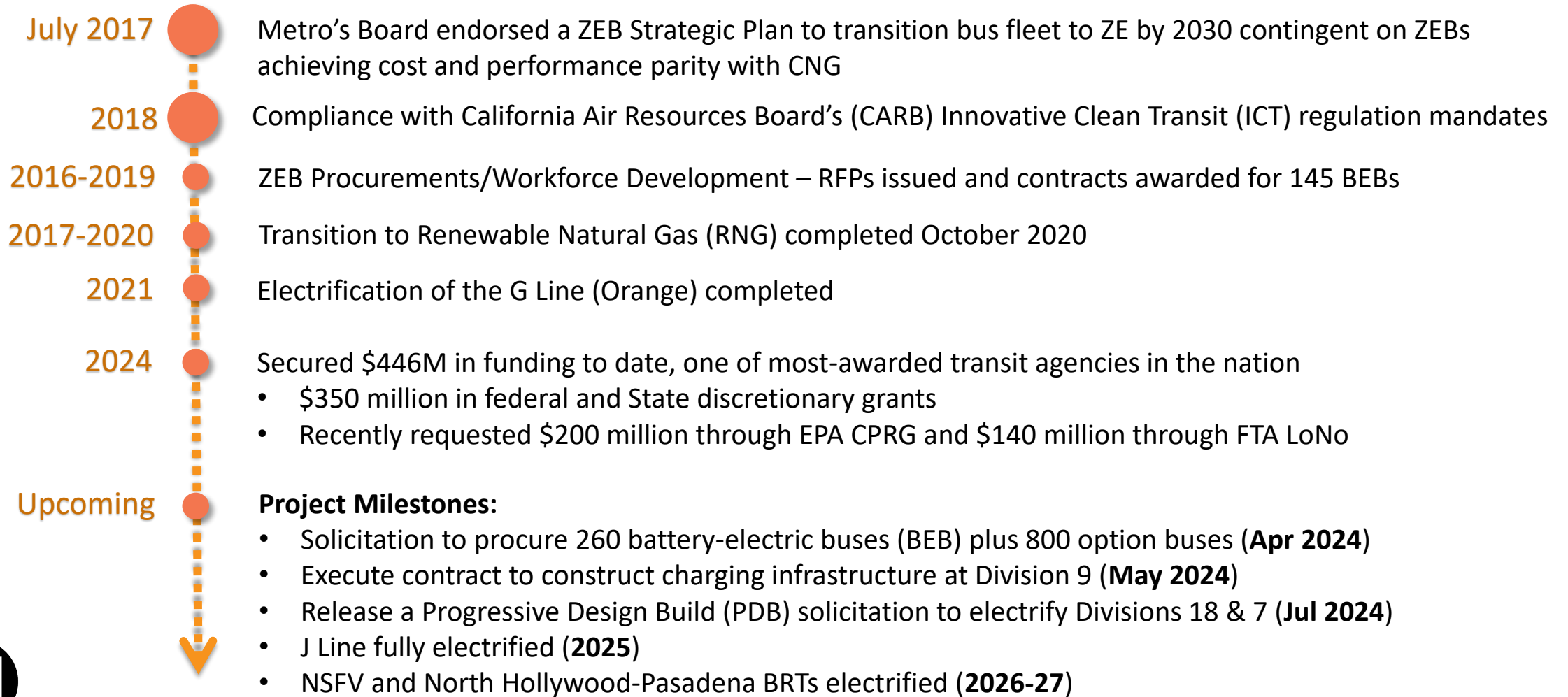
Annual reduction per bus **75** metric ton CO₂e

Total bus fleet reduction* **152,325** metric ton CO₂e

Per mile reduction* **1.26** pounds CO₂e

Future economic damages that can be avoided by reducing GHG emissions per year** **\$9.6M**

Progress Made to Date



Metro's ZEB Program Leadership



- Vice Chair APTA Bus Technical Maintenance Committee since 2019
- Board Member California Transit Training Consortium (CTTC), a leading provider of technical training to the transit industry
- Active member UITP Working Groups and Bus Committee, worldwide association of public transport stakeholders (*hosted committee in April 2024*)
- CEO participated in the White House Roundtable on Clean Bus Manufacturing in January 2024
- Founding member and Vice President of Advanced Transit Vehicle Consortium (ATVC) Ad Hoc Committee of local agencies exploring alternative fuels
- Evaluation of alternative delivery options (Charging-as-a-Service) and market soundings (2021 - 2023)
- Developing a regional procurement approach for ZEB purchases that includes municipal operators (November 2023 – present)



Metro[®]

Acknowledging Challenges



BEB Performance

- Range
- Reliability
- Maintainability
- Operability
- Obsolescence

Utility, Infrastructure, & Supply Chain

- Long lead time for grid upgrades
- Grid capacity
- Market availability

Costs

- ZEB continues to cost more to purchase than CNG buses
- Charging infrastructure costs are significant
- Operating costs of BEBs have been high with initial deployments.
- The 2030 target requires an estimated \$675 million in annual cash flow.

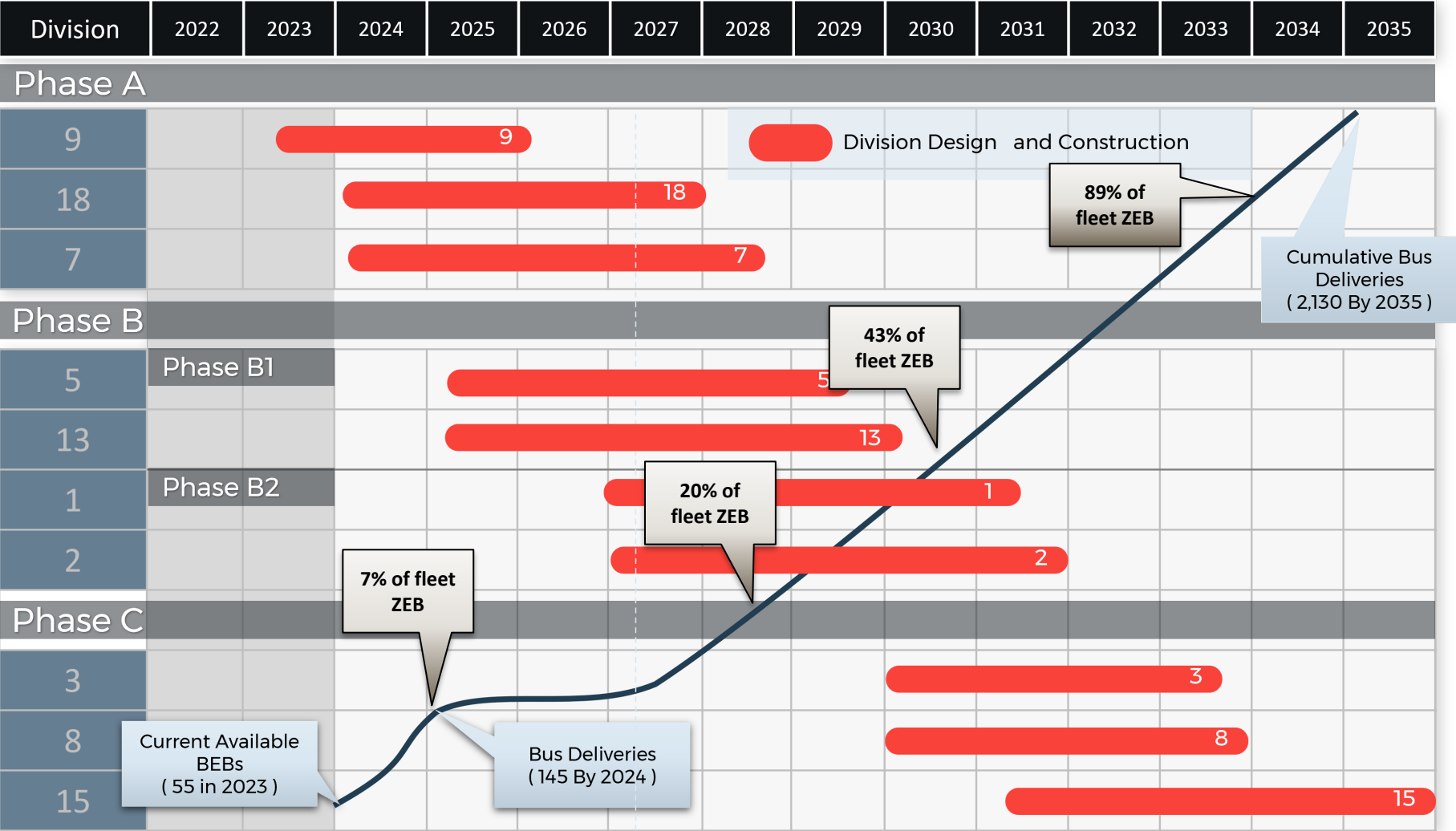
Maintaining Reliable Service

- Ensure reliable operation of Metro's 7 million annual revenue service hours
- ZEB technology must prove reliable and able to support the majority of bus routes
- Phase Division construction to avoid impacts to storage, maintenance, and operation of 2,000+ bus fleet

U.S. Bus Market

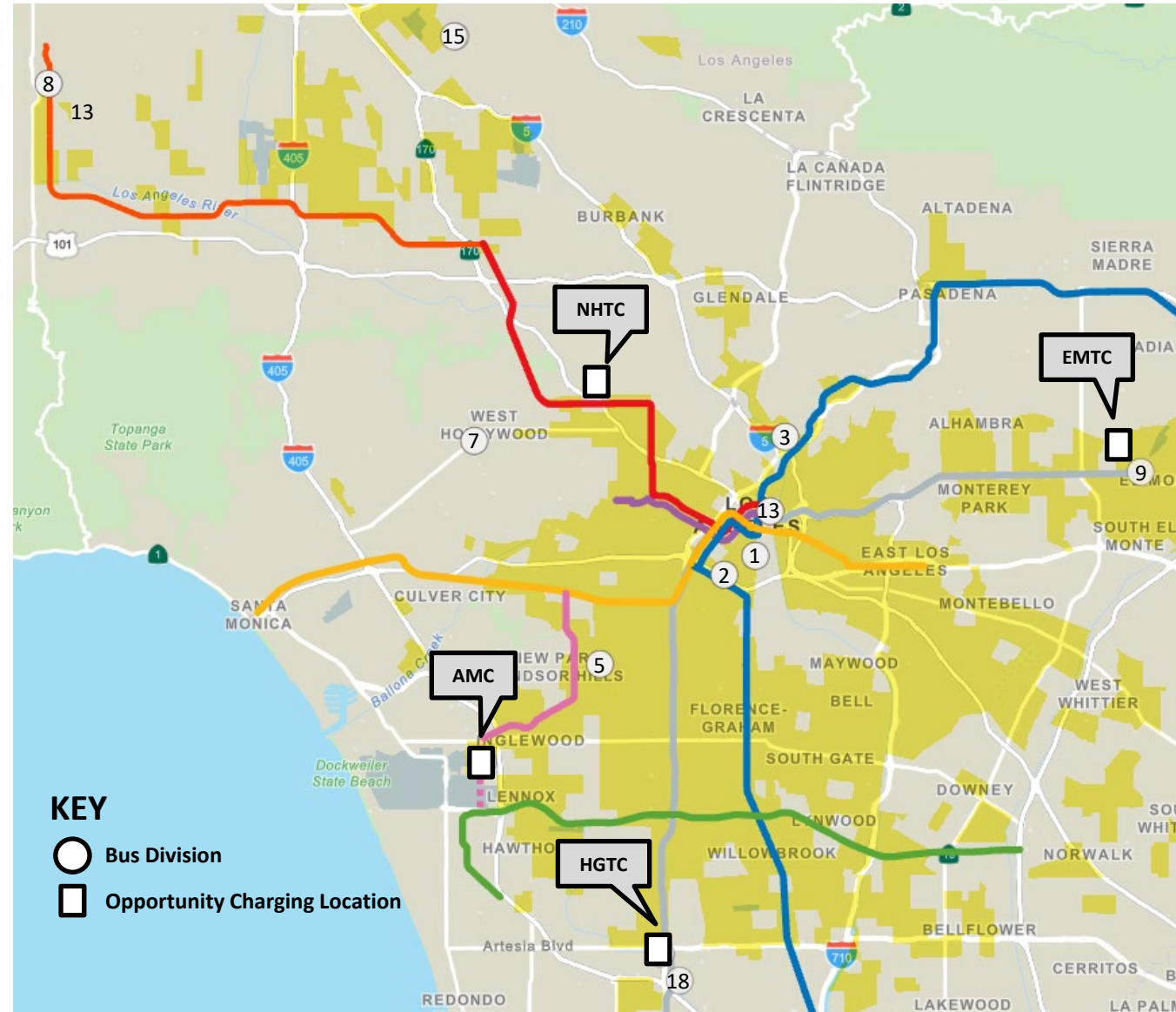
- Two Buy America compliant OEMs remain (three exited market past 12 months)
- Historically, one of the remaining OEMs does not participate in large solicitations

Revised ZEB Program Phasing Schedule



Current Status – Phase A Equity Lens

- Prioritizing the **J Line** will bring environmental benefits to some of the region's most densely populated, congested, and polluted communities, many of which are EFCs
- **Division 9** is located within an EFC and CalEnviroScreen DAC. 59% of communities served are designated DACs.
- **Division 18** is located within a DAC. 70% of communities served are designated DACs.
- **Division 7** - 52% of communities served are designated DACs.



THANK YOU

