June 30, 2020

Mr. Richard Corey
Executive Officer
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Subject: **Orange County Transportation Authority's Zero-Emission Bus Rollout Plan**

Dear Mr. Corey:

Enclosed is the initial Orange County Transportation Authority (OCTA) Zero-Emission Bus Rollout Plan as required by the Innovative Clean Transit (ICT) Regulation. The plan will help inform OCTA's phased transition to a zero-emission fleet by 2040. The plan is built on what is known today about technology and cost, which will evolve over time based on operating experience and technology innovations.

OCTA is underway with gathering more data about the reliability and cost-effectiveness of the various zero-emission technologies in different operating conditions. This year, OCTA expanded the number of hydrogen fuel-cell electric buses in revenue operations to ten and commissioned the nation's largest transit hydrogen fueling station, supported by funding provided by the state. In addition, OCTA is procuring ten battery-electric buses this year to test both technologies in revenue service. Testing both hydrogen fuel-cell and battery electric buses will allow OCTA to collect valuable data and to inform which technology – or the best mix of technologies – to pursue moving forward. It is OCTA's goal to work with all our partners at the local, state, and federal level to identify the most appropriate fueling technologies and to secure funding for the necessary capital, infrastructure, and operations and maintenance costs to implement this plan. OCTA's future plans also need to acknowledge that the novel coronavirus (COVID-19) pandemic has impacted transit demand, funding, and operations, and OCTA's short- and long-term transit plans are likely to change as a result of COVID-19. OCTA will continue to keep the California Air Resources Board informed on key plan changes given these new fiscal realities.

OCTA values your feedback and direction for future revisions of the plan. Should you have any questions about the Plan, please contact Jorge Duran, P inal Analyst, at (714) 560-5765 or jduran@octa.net.

Darrell E. Johnson
Chief Executive Officer

Enclosure

# ORANGE COUNTY TRANSPORTATION AUTHORITY

# Zero-Emission Bus Draft Rollout Plan

**Revised: June 3, 2020**

# SECTION A: TRANSIT AGENCY INFORMATION

*Please provide the following information regarding your agency.*

Orange County Transportation Authority (OCTA)
550 South Main Street
Orange, CA 92863

OCTA is part of South Coast Air Quality Management District (AQMD) and part of South Coast Air Basin.

Peak Vehicles: 421
Population: 3,268,084

Contact Information
Name: Darrell E. Johnson
Title: Chief Executive Officer
Phone Number: (714) 560-5343
Email address: djohnson@octa.net

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

# Section B: Rollout Plan General Information

*Does your transit agency's Rollout Plan have a goal of full transition to zero-emission technologies by 2040 that avoids early retirement of conventional transit buses*? Yes

*The ICT regulation requires 100% ZEB purchases in 2029. Conventional transit buses that are purchased in 2028 could be delivered in or after 2029. Please explain how your transit agency plans to avoid potential early retirement of conventional buses in order to meet the 2040 goal.* OCTA will adhere to the FTA fleet retirement requirements.

*When did your transit agency's board or governing body approve the Rollout Plan?*

Approval date 06/22/2020

Resolution No. 2020-055

*Is a copy of the Board-approved resolution attached to the Rollout Plan submitted to CARB?* Yes

*Contact information for follow-up on details of the Rollout Plan*

Contact name: Jorge Duran

Title: Service Planning Analyst, Principal

Phone number: (714) 560-5765

Email: jduran@octa.net

*Who created the rollout plan?* OCTA staff with consultant's assistance

# Section C: Technology Portfolio

*What type(s) of zero-emission bus technologies (e.g. battery electric and fuel cell electric buses) does your transit agency plan to deploy through 2040?*

OCTA began to deploy fuel cell electric buses (FCEB) in late 2019 and early 2020 and plans to deploy battery electric buses (BEB) in 2023 as pilot projects. Per ICT Regulation, the Rollout Plan presents a strategy for how the agency plans to deploy ZEBs through 2040. As such, it is a living document that will be updated as technology evolves. At this time, our extensive modeling shows that FCEB is the best fit for OCTA's operational needs. The optimal fleet mix will evolve as ZEB technology advances in the short and long-term. OCTA will be conducting pilots to test ten FCEBs and ten BEBs to inform the final decision and long-term ZEB strategy.

OCTA does not need to purchase ZEBs for fixed-route until 2029 when twenty 60-foot articulated buses are due for replacement, as shown in Table 2a in Section D. At that time, per the ICT regulation, 100 percent of the vehicles purchased would have to be ZEBs. OCTA will need to purchase ZEBs for the paratransit fleet in 2026, when 50 percent of the vehicles must be ZEBs, as shown in Table 2b in Section D. The current assumption is that the ZEB fuel type would be battery-electric and that an Altoona-tested vehicle exists. A study is underway to analyze the optimal paratransit fleet mix. The result of this study will inform OCTA on the type and size of vehicles to purchase, as well as fueling technology and when Altoona testing has been conducted on this vehicle type.

The table on the following page summarizes the options analyzed that helped OCTA develop a ZEB transition strategy for its fixed-route fleet.

## Fleet Fit Trade-Off Qualitative Considerations for General Criteria (Agency-wide)

| Trade-off/criteria | Option A (100% FCEBs) | Option B (blended fleet inclusive of 61% FCEBs, 15% depot-only charging BEBs, and 24% depot+on-route charging BEBs) | Notes/comments |
|---|---|---|---|
| **Scheduling and planning** | • Requires scheduling consideration for FCEB **average** range of ~280 mi (37.5 kg tank) and 365 mi (50 kg tank)<br>• FCEBs offer greatest flexibility for detours and other unplanned/planned service changes and road calls/changeouts<br>• Two to three buses with FCEBs (50 kg tanks) may require midday refueling (depending on operating conditions) to complete service as currently blocked/scheduled<br>• One block will need redesigning<br>• Smaller battery pack in FCEBs experience less degradation than BEBs so that operating range decreases are less significant over time, making service planning more consistent and with fewer variables to consider<br>  | • Requires scheduling consideration for FCEB **average** range of ~280 mi (37.5 kg tank) and 365 mi (50 kg tank)<br>• Requires scheduling consideration for BEB (400+ kWh battery models) **average** range of ~160-180 mi<br>• Requires consideration of mixed fleet to ensure that appropriate units are scheduled for appropriate blocks/services<br>• Two to three buses with FCEBs (50 kg tanks) may require midday refueling (depending on operating conditions) to complete service as currently blocked/scheduled<br>• One block will need redesigning<br>• Smaller battery pack in FCEBs experience less degradation than BEBs so that operating range decreases are less significant over time<br>• Degradation of BEB batteries can significantly decrease the operating range over time, adding complexity to service redesign<br>  | • FCEB range most closely approximates to current CNG range<br>• FCEB most closely resembles current CNG "business as usual" scenario at OCTA<br>• Leverages OCTA's experience with FCEBs<br>• Option A presents the simplest scheduling considerations and minimizes reblocking<br>• Bravo service would require particular attention if Bravo-branded buses are of only one type of technology and this would increase the bus variants required in Option B (2 service types, OCBus and Bravo, x3 technologies, vs. 2 service types and x1 technology in Option A) |

| Trade-off/criteria | Option A (100% FCEBs) | Option B (blended fleet inclusive of 61% FCEBs, 15% depot-only charging BEBs, and 24% depot+on-route charging BEBs) | Notes/comments |
|---|---|---|---|
| **Operations and dispatching** | • All units can be dispatched for nearly any service or block<br>• Dispatch will have greater flexibility to assign units to blocks because of comparable ranges across vehicles, which will maintain a comparable yearly mileage among FCEBs<br>• Refueling hydrogen on FCEBs can be completed during a 7-hr refueling window as currently done for CNG buses (hydrogen fueling station equipment designed to fill FCEBs in under 10 minutes, as per peer agency experience)<br>• Fueling, cleaning, and maintenance and other service cycle functions would require minimal changes for FCEBs<br>  | • Dispatch (and maintenance) will need to consider and manage two technologies when buses leave and return to the garages, as well as different ranges to ensure units are dispatched as scheduled to the correct blocks<br>• Bus assignment between blocks will be limited due to driving range of BEBs, resulting in fewer accumulated yearly mileage than FCEBs<br>• Fueling, cleaning, maintenance and other service cycle functions will require modification for BEBs<br>• Parking and charging times for BEBs needs to be closely monitored to ensure a full state of charge and free dispatching for the next service day<br>• Recharging BEBs can take between two and six hours and will likely require swapping dispensers' connections to buses overnight or smart charging software to manage charge remotely<br>• Refueling hydrogen on FCEBs can be completed during a 7-hr refueling window as currently done for CNG buses (hydrogen fueling station equipment designed to fill FCEBs in under 10 minutes, as per peer agency and OCTA experience)<br>• Fueling, cleaning, and maintenance and other service cycle functions would require minimal to no change for changes for FCEBs<br>  | • Having the fewest variants or types of bus technologies is preferable especially given OCTA's multiple service types<br>• Operations and dispatching of FCEBs will be closer to OCTA's business as usual and comparable to operations of CNG buses<br>• Leverages operations' and dispatching's experience with FCEBs<br>• Managing charging of BEBs adds to the operational activities of OCTA's staff and would likely result in additional personnel and shift modifications |
| **Training and agency-wide adoption** | • Requires training for operators, mechanics, schedulers, etc. for FCEBs<br>  | • Requires training for operators, mechanics, schedulers, etc. for BEBs<br>• Requires training for operators, mechanics, schedulers, etc. for FCEBs<br>  | • Option A presents a less steep learning curve than Option B because it recommends one technology type rather than two<br>• Option A leverages existing in-house expertise and experience with FCEBs |

| Trade-off/criteria | Option A (100% FCEBs) | Option B (blended fleet inclusive of 61% FCEBs, 15% depot-only charging BEBs, and 24% depot+on-route charging BEBs) | Notes/comments |
|---|---|---|---|
| **Technology availability/ OEMs/procurement** | • Fewer FCEB OEMs at present<br>• Procurement would require one procurement contract/process<br>• Requires one set of spare parts, tools, etc. for FCEBs<br>  | • More BEB OEMs<br>• Fewer FCEB OEMs at present<br>• Procurement would require two separate procurements contracts<br>• Requires two sets of spare parts, tools, etc. for BEBs and FCEBs<br>  | • Option A relies on FCEBs solely, and there are fewer OEMs available than for BEBs<br>• Option A would require fewer tools and spare parts than Option B |
| **Service area-specific considerations** | • OCTA has a relatively compact service area (435 sq. mi.) with hills and several routes with cruising (i.e., freeway-type) portions<br>• FCEBs provide flexibility to short and long routes, but special planning for hilly routes<br>  | • OCTA has relatively compact service area (435 sq. mi.) with hills and several routes with cruising (i.e., freeway-type) portions<br>• FCEBs provide flexibility to short and long routes, but special planning for hilly routes<br>• BEBs could provide better fuel economy on stop-and-go (urban) services<br>• Installation of on-route chargers require permitting and buy-in from project jurisdiction<br>  | • Option A provides the most flexibility for all OCTA services<br>• Option B requires coordination for on-route charging infrastructure with different jurisdictions in Orange County |
| **Total cost of ownership** | • Estimated TCO is $2.05 per mile (per bus) over 18 years<br>  | • Estimated TCO at $2.07 per mile (per bus) over 18 years<br>  | • Hydrogen infrastructure becomes comparable to BEBs in cost with unit discount for large purchases<br>• TCO estimates include capital investment for infrastructure and bus acquisition, operational considerations like maintenance and fuel cost, and mid-life battery or FC replacement. The TCO per mile for Option B is 1% lower than for Option A.<br>• Initial upfront capital cost of Option B is 9% lower than Option A<br>• From an O&M life cycle perspective, Option B is 12% more expensive overall relative to Option A. |

| Trade-off/criteria | Option A (100% FCEBs) | Option B (blended fleet inclusive of 61% FCEBs, 15% depot-only charging BEBs, and 24% depot+on-route charging BEBs) | Notes/comments |
|---|---|---|---|
| **Other** | • Power resiliency requires diesel or CNG generator for FCEB fueling infrastructure<br>• Deviation from modeled fuel efficiency of FCEBs can be mitigated by additional refueling during the day either at an OCTA garage or by arranging fueling contracts with public hydrogen stations currently expanding across California<br>  | • Power resiliency requires diesel or CNG generator for BEB and FCEB fueling infrastructure<br>• Range requirements could be accommodated by midday fueling of FCEBs with municipal or shared infrastructure<br>• Range requirements for BEBs would require in-depot charging for several hours, either during the day or overnight<br>• Deviation from the modeled fuel efficiency when operating buses under real operations can be disruptive for BEBs and could represent adding additional buses to complete service<br>  | |
| **Overall fit for OCTA** |  |  | |

# Section D: Current Bus Fleet Composition and Future Bus Purchases

*Please complete Table 1 with information on each individual bus in your current bus fleet. Please identify the fuel type of each individual conventional bus as diesel, compressed natural gas (CNG), liquefied natural gas (LNG), diesel hybrid (dHEB), gasoline hybrid (gHEB), propane, or gasoline.*

**Table 1: Current Bus Fleet Composition**

| Bus Series | Bus Type | Fuel Type | Model Year | QTY |
|---|---|---|---|---|
| 5121-50 | Standard | CNG | 2007 | 30 |
| 5501-99 | Standard | CNG | 2007 | 99 |
| 5601-74 | Standard | CNG | 2007 | 74 |
| 5675-78 | Standard | CNG | 2008 | 4 |
| 7501-28 | Standard | CNG | 2007 | 28 |
| 7529-92 | Standard | CNG | 2008 | 64 |
| 7601-20 | Articulated | CNG | 2013 | 20 |
| 5701-99 | Standard | CNG | 2016 | 99 |
| 5801-58 | Standard | CNG | 2016 | 58 |
| 7621-36 | Articulated | CNG | 2016 | 16 |
| 5861-5866 | Standard | CNG | 2018 | 6 |
| 1111-20 | Standard | FCEB | 2019 | 10 |
| 6805/06 | Cutaway | UNL | 2010 | 2 |
| 6911-27 | Cutaway | UNL | 2013 | 17 |
| 8501-99 | Cutaway | UNL | 2014 | 98 |
| 8601-99 | Cutaway | UNL | 2016 | 99 |
| 8701-33 | Cutaway | UNL | 2016 | 32 |
| Total | | | | 756 |

*Please complete Table 2 regarding expected future bus purchases, including the number of buses in total expected to be purchased or leased in the year of purchase. Identify the number and percentage of ZEBs of the total bus purchases each year, as well as bus types and fuel types. Identify the same type of information for purchases of conventional buses. Bus types include standard, articulated, over-the-road, double decker, and cutaway buses. For zero-emission technologies,* identify the fuel type as hydrogen or electricity and the type of charging technology (depot, wireless, and/or on-route). For conventional technologies *identify the fuel type as diesel, CNG, LNG, diesel hybrid (dHEB), gasoline hybrid (gHEB), propane, or gasoline.*

Table 2a illustrates the anticipated fixed route buses that will be purchased in the future and Table 2b depicts anticipated paratransit cutaway purchase schedule.

**Table 2a: Future Fixed Route Bus Purchases (Required)**

| Timeline (Year) | Total # of Buses to Purchase | # of ZEB Purchases | % of Annual ZEB Purchases | ZEB Bus Type(s) | ZEB Fuel Type(s) | # of Conv. Bus Purchases | % of Annual Conv. Bus Purchases | Type(s) of Conv. Buses | Fuel Type(s) of Conv. Buses |
|---|---|---|---|---|---|---|---|---|---|
| **2020** | 304 | 10 | 3% | Standard | BEB | 294 | 97% | Standard | CNG |
| **2021** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2022** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2023** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2024** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2025** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2026** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2027** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2028** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2029** | 20 | 20 | 100% | Articulated | FCEB | 0 | 0% | - | - |
| **2030** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2031** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2032** | 157 | 157 | 100% | Standard | FCEB/BEB | 0 | 0% | - | - |
| | 16 | 16 | 100% | Articulated | FCEB | 0 | 0% | - | - |
| **2033** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2034** | 6 | 6 | 100% | Standard | FCEB | 0 | 0% | - | - |
| **2035** | 10 | 10 | 100% | Standard | FCEB | 0 | 0% | - | - |
| **2036** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2037** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2038** | 304 | 304 | 100% | Standard | FCEB | 0 | 0% | - | - |
| **2039** | 0 | 0 | - | - | - | 0 | - | - | - |
| **2040** | 0 | 0 | - | - | - | 0 | - | - | - |

*Note: Purchase date is two years prior to required for service to allow for procurement and manufacturing*

**Table 2b: Future Paratransit Cutaway Bus Purchases (Required)**

| Timeline (Year) | Total # of Buses to Purchase | # of ZEB Purchases | % of Annual ZEB Purchases | ZEB Bus Type(s) | ZEB Fuel Type(s) | # of Conv. Bus Purchases | % of Annual Conv. Bus Purchases | Type(s) of Conv. Buses | Fuel Type(s) of Conv. Buses |
|---|---|---|---|---|---|---|---|---|---|
| **2020** | 116 | 0 | 0% | Cutaway | - | 116 | 100% | Cutaway | Unleaded |
| **2021** | 3 | 0 | 0% | Cutaway | - | 3 | 100% | Cutaway | Unleaded |
| | | | | | - | | | | |
| **2023** | 3 | 0 | 0% | Cutaway | - | 3 | 100% | Cutaway | Unleaded |
| | | | | | - | | | | |
| **2025** | 5 | 0 | 0% | Cutaway | - | 5 | 100% | Cutaway | Unleaded |
| | | | | | | | | | |
| **2027** | 122 | 61 | 50% | Cutaway | BEB | 61 | 50% | Cutaway | Unleaded |
| | | | | | | | | | |
| **2029** | 136 | 136 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| **2030** | 6 | 6 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| **2031** | 5 | 5 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| | | | | | | | | - | - |
| **2033** | 7 | 7 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| | | | | | | | | - | - |
| **2035** | 8 | 8 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| | | | | | | | | - | - |
| **2037** | 9 | 9 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| | | | | | | | | - | - |
| **2039** | 10 | 10 | 100% | Cutaway | BEB | 0 | 0% | - | - |
| **2040** | 0 | 0 | 0% | - | - | 0 | 0 | - | - |

*Note: Purchase date is one year prior to required for service to allow for procurement and manufacturing*

*Is your transit agency considering converting some of the conventional buses in service to zero-emission buses?* OCTA is not considering converting conventional buses to zero-emission buses.

# Section E: Facilities and Infrastructure Modifications

*Please complete Table 5 with names, locations, and main functions of transit agency divisions or facilities that would be involved in deploying and maintaining zero-emission buses. Please limit the facilities to bus yards and facilities with maintenance, fueling, and charging functions, and exclude other operational functions like training centers, information and trip planning offices, and administrative buildings.*

OCTA will have to make modifications to its divisions to accommodate the transition to zero-emission. Below is a table that identifies possible facilities and infrastructure modifications.

**Table 5: Facilities and Infrastructure Modifications Timeline (Required)**

| Division/ Facility Name | Address | Main Function(s) | Type(s) of Infrastructure | Service Capacity (Buses) | Needs Upgrade? (Yes/No) | Estimated Construction Timeline |
|---|---|---|---|---|---|---|
| **Anaheim Base** | 1717 E. Via Burton, Anaheim, CA 92806 | Bus Operations & Maintenance | New hydrogen fueling station & dispensers, new gas detection system and site improvements. | 150 | Yes | Beginning in 2030 – about 2 years prior to arrival of first ZEBs at this base |
| **Garden Grove Base** | 11800 Woodbury Road, Garden Grove, CA 92843 | Bus Operations & Maintenance | New hydrogen fueling station & dispensers, new gas detection system, new battery electric infrastructure, and site improvements | 150 | Yes | Beginning in 2021, about 2 years prior to arrival of first BEBs at this base |
| **Irvine Base** | 14736 Sand Canyon Road, Irvine, CA 92618 | Bus Operations & Maintenance | New hydrogen fueling station & dispensers, new gas detection system and site improvements. | 125 | Yes | Beginning in 2030 – about 2 years prior to arrival of first ZEBs at this base |
| **Irvine Construction Circle Base** | 16281 Construction Circle, Irvine, CA 92606 | Bus Operations & Maintenance | Unknown at this time but may require new battery electric infrastructure, and site improvements | 250 | Yes | Beginning in 2024, about 2 years prior to arrival of first BEBs at this base |
| **Santa Ana Base** | 4301 W. MacArthur Blvd., Santa Ana, CA 92704 | Bus Operations & Maintenance | Expand hydrogen fueling station & dispensers and site improvements | 245 | Yes | FCEB infrastructure is operational at this base. Will need to expand beginning in 2030 – about 2 years prior to arrival of additional ZEBs at this base |

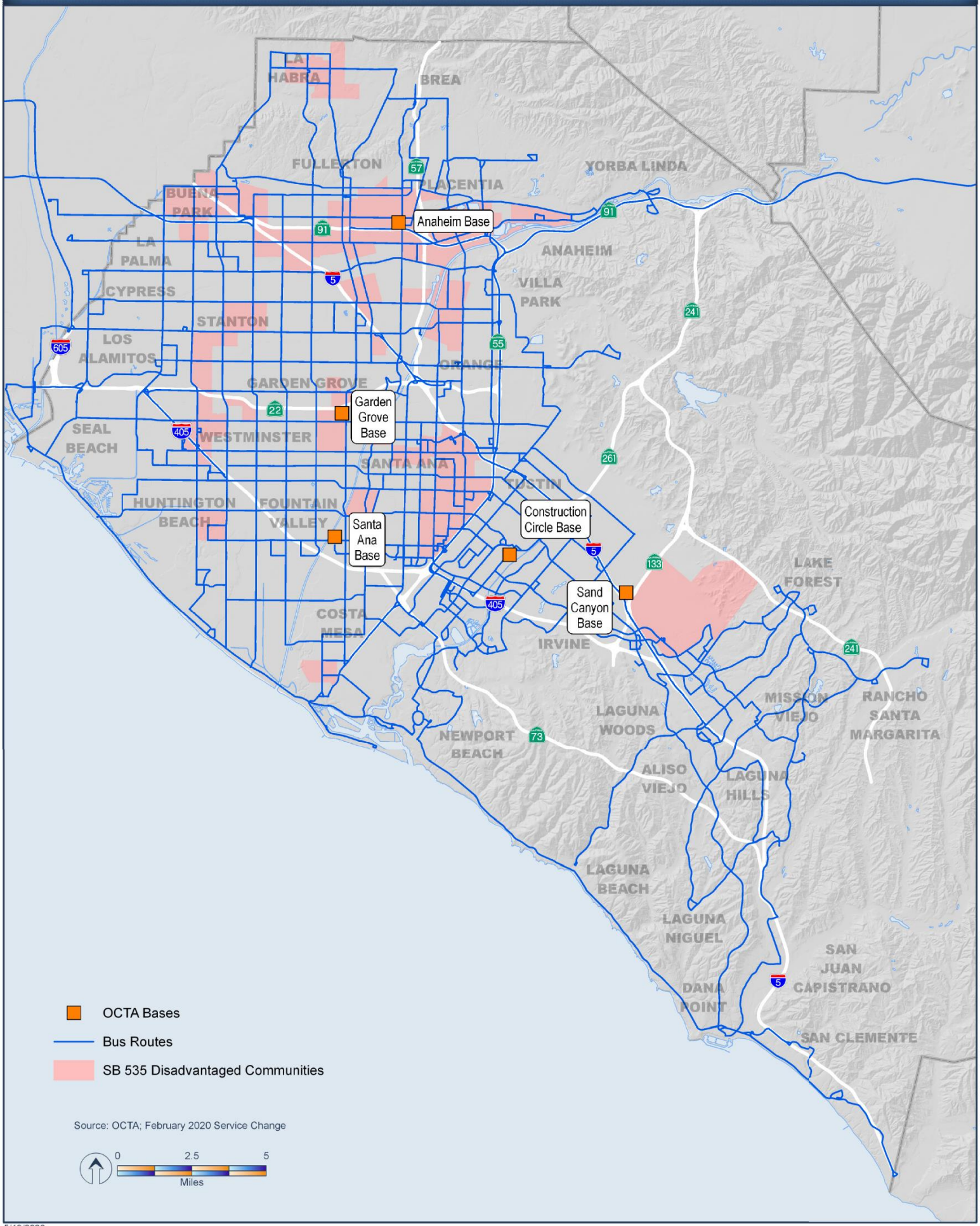
*Electric utilities in OCTA's service area are Southern California Edison (SCE) and the City of Anaheim.*

# Section F: Providing Service in Disadvantaged Communities

*Does your transit agency serve one or more disadvantaged communities, as listed in the latest version of CalEnviroScreen?* Yes. OCTA does serve one or more disadvantaged communities as listed in the latest version of CalEnviroScreen.

The figure on the next page shows the disadvantaged communities in OCTA's service area as defined under the CalEnviroScreen definition. There are 71 disadvantaged communities (DACs) in Orange County, which account for about 12 percent of all census tracts. Analysis shows that all DACs are served with transit. Forty-seven OCTA routes touch at least one disadvantaged community. The routes primarily operate from OCTA's Santa Ana and Garden Grove bases. OCTA began deploying ZEBs in DACs with the initial FCEB pilot project in early 2020. The upcoming BEB pilot will also be deployed on primarily routes serving DACs. In general, the newer ZEBs will be assigned to routes serving low-income and minority communities per the agencies Fleet Assignment Policy.

# Zero Emission Bus Rollout Plan




5/19/2020

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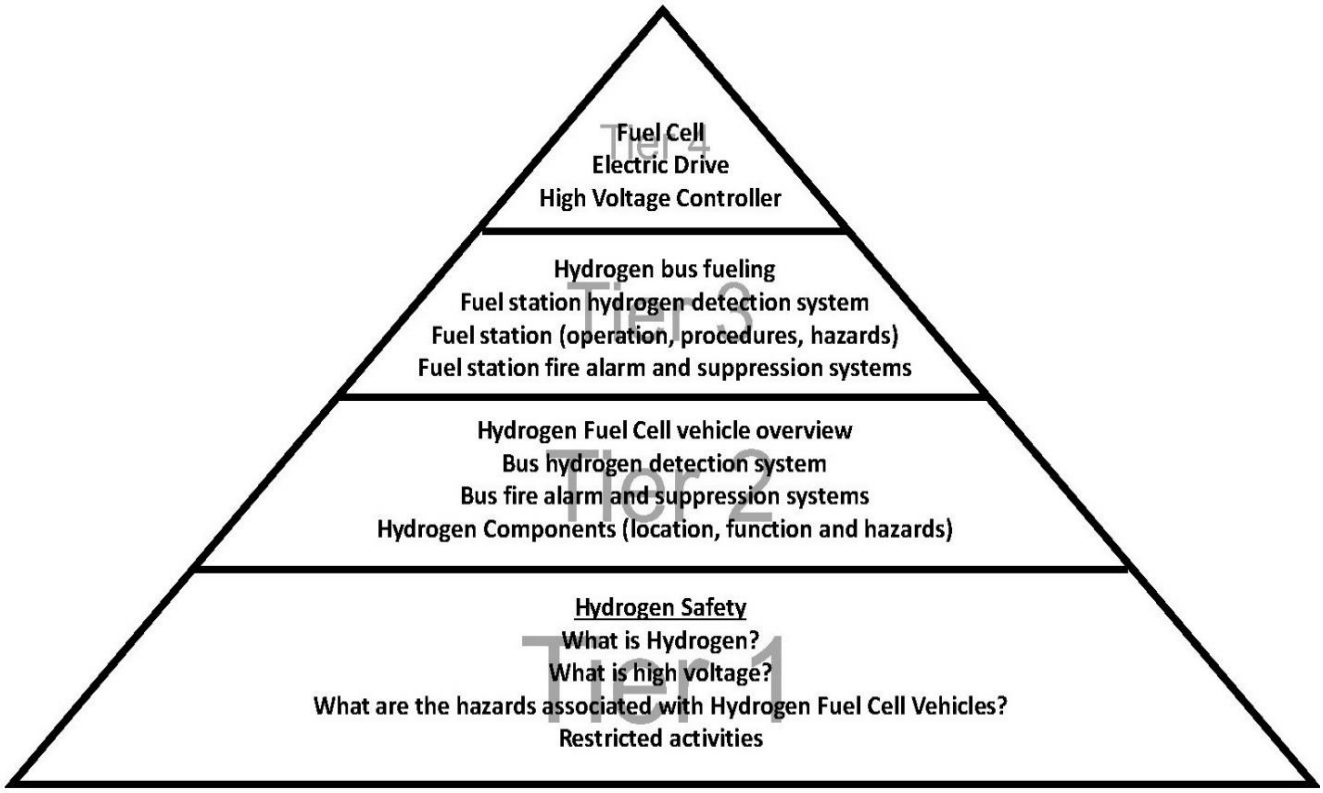
# Section G: Workforce Training

*Describe your transit agency's plan and schedule for the training of bus operators and maintenance and repair staff on zero-emission bus technologies. (Required)*

OCTA is well prepared to transition its fleet to ZEBs with the experience gained from running two ZEB pilot projects. OCTA began operating FCEBs in revenue service with the acquisition of ten FCEBs in late 2019. OCTA also commissioned a hydrogen fueling station that can accommodate up to 50 buses and can easily be expanded. Staff across all disciplines have been trained in the operations and maintenance of the FCEB fleet. In addition, OCTA will begin the procurement of ten BEBs in late 2020. These BEBs are expected to be in revenue service in 2023, prior to when the ICT Regulation to purchase ZEBs kicks in.

Working closely with OEMs, OCTA developed and implemented a very successful training plan tor the FCEB fleet. It is a four-tier plan that provides customized training across all levels of the organization. For training purposes, the training plan is designed as a triangle. The base of the pyramid being Tier 1 that describes the basics of the specific technology and includes staff throughout the entire organization. The top of the pyramid being Tier 4, is for a smaller number of personnel who directly work on the equipment or train staff on the technology. These tiers are explained below. This efficient training plan will be used as a model for the required training on the BEB fleet. It will be specifically customized to address BEB technology.




Tier 1: Involves all OCTA personnel who will have any contact with vehicles, fueling station, and service equipment, including the following staff:

- Operations - 658 total employees including staff and drivers.
- Operations support - 31 total employees including communications, field operations and planning.
- Maintenance - 200 total employees including staff, mechanics, service workers, and facilities technicians.
- Contract Administration & Materials Management - 25 total employees including staff and parts clerks.
- Training and Development - 19 total employees including instructors and support staff.
- Orange County Sheriff - 31 total employees including staff and officers.
- Total personnel initially requiring Tier 1 training – 964

Tier 2: Involves all OCTA personnel who will have daily contact with vehicles, fueling station, and service equipment, including the following staff.

- Operations - 633 drivers. (This number assumes all drivers are to be trained.)
- Operations support - 31 field operations employees.
- Maintenance - 200 employees including staff, mechanics, service workers, and facilities technicians.
- Training and Development - 19 total instructors.

Tier 3: Involves all OCTA personnel who are directly involved in service or repair of vehicles, fueling station, and service equipment.

- Maintenance - 200 total employees including staff, mechanics, service workers, and facilities technicians.
- Training and Development - 3 maintenance instructors.
- Total personnel initially requiring Tier 3 training - 203

Tier 4: Involves all OCTA personnel who are directly involved with the diagnosis or repair of Hydrogen Fuel Cell, high voltage, control, or bus electrical systems.

- Maintenance - 4 Advanced Tech mechanics.
- Training and Development - 3 maintenance instructors.

The table below provides a high-level overview of OCTA's plan and schedule for the training of all staff throughout the agency on ZEB technologies. This plan is subject to change based on financial, technological, and agency direction.

**Table 8: Workforce Training Schedule (Optional)**

| Timeline (year) | Maintenance/Technician Training | Operator Training | Other Staff Training |
|---|---|---|---|
| **FY2020** | Conduct four-tier training for 10 FCEBs pilot project | Conduct four-tier training for 10 FCEBs pilot project | Conduct four-tier training for 10 FCEBs pilot project |
| **FY2021** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2022** | Conduct four-tier training for 10 BEBs pilot project | Conduct four-tier training for 10 BEBs pilot project at the Garden Grove Base | Conduct four-tier training for 10 BEBs pilot project |
| **FU2023** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2024** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2025** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2026** | Conduct four-tier training for initial delivery of ZEB paratransit fleet at Irvine Construction Circle Base | Conduct four-tier training for initial delivery of ZEB paratransit fleet at Irvine Construction Circle Base | Conduct four-tier training for initial delivery of ZEB paratransit fleet at Irvine Construction Circle Base |
| **FY2027** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2028** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2029** | Conduct four-tier training for expansion of ZEB fleet (20 articulated buses) | Conduct four-tier training for expansion of ZEB fleet (20 articulated buses) | Conduct four-tier training for expansion of ZEB fleet (20 articulated buses) |
| **FY2030** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2031** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2032** | Conduct four-tier training for significant expansion of ZEB fleet (157 40-ft and 16 articulated buses) | Conduct four-tier training for significant expansion of ZEB fleet (157 40-ft and 16 articulated buses) | As needed |
| **FY2033** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2034** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2035** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2036** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2037** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2038** | Conduct four-tier training for significant expansion of ZEB fleet (304 40-ft buses) | Conduct four-tier training for significant expansion of ZEB fleet (304 40-ft buses) | Conduct four-tier training for significant expansion of ZEB fleet (304 40-ft buses) |
| **FY2039** | Annual refreshers training | Annual refreshers training | As needed |
| **FY2040** | Annual refreshers training | Annual refreshers training | As needed |

# Section H: Potential Funding Sources

*Please identify all potential funding sources your transit agency expects to use to acquire zero-emission technologies (both vehicles and infrastructure).*

There are a variety of potential funding sources that OCTA will explore to partially fund the acquisition of zero-emission technologies. With a combination of these funding sources, OCTA will be in a position to successfully transition to ZEB technologies. When grant funding cannot be obtained, OCTA will need to use local tax revenue for ZEB related costs.

**Table 9: Potential Funding Sources (Optional)**

| Fund/Grant | Level of government | Description | Applicability |
|---|---|---|---|
| **HVIP** | State/CARB | Voucher program aimed at reducing the purchase cost of zero-emission vehicles.<br><br>A transit agency would decide on a vehicle, contact the vendor directly, and then the vendor would apply for the voucher. | OCTA does not need to apply; the vendor handles the application process. |
| **Low Carbon Transit Operations Program (LCTOP) and Transit and Intercity Rail Capital Program (TIRCP)** | State/CARB/Caltrans | LCTOP is a formula-driven program and TIRCP is a competitive program.<br><br>These programs fund projects that support new or expanded bus and rail services, improve multimodal facilities and can include equipment, fueling, maintenance and other costs. | OCTA is already recipient of these funds and can use these funds to purchase ZEBs and related equipment.<br><br>Both programs require the agency demonstrate GHG emissions reductions. |
| **Low Carbon Fuel Standard (LCFS credits)** | NA | LCFS credits are not necessary funding to be applied for; rather, they are offset credits that are traded (through a broker) to reduce operating costs. | Once ZEBs are acquired and operating, OCTA can collect LCFS and 'sell' them to reduce operating costs of ZEBs. |
| **VW Environmental Mitigation Trust Funding** | State | VW's settlement provides nearly $130 million for zero-emission transit, school, and shuttle bus replacements. Transit may be eligible for up to $65 million. | Applications are now open for transit agencies. The grant is a one-time deal. OCTA may apply through the online portal as soon as it adopts the ZEB plan. |
| **Carl Moyer and AB 923** | State/CARB | Funding to help procure low-emission vehicles and equipment.<br><br>Transit buses are eligible for up to $80,000 funding. | As a fleet larger than 10 vehicles, OCTA would be eligible for $80,000 or 50% of the vehicle cost (whichever is lower). |

| Fund/Grant | Level of government | Description | Applicability |
|---|---|---|---|
| **AB 617** | State/CARB | Community Air Grants constitutes CARB's overall effort to implement AB 617, providing $250 million in FY17-18 and $245 million additional in FY18-19.<br><br>This funding can be used for engine replacement, repower, and infrastructure. | OCTA will monitor this fund and apply when ready. Can be used to purchase infrastructure like hydrogen fueling, etc. Since OCTA will likely acquire new ZEBs, AB 617 will not offset the capital purchase cost of ZEBs. |
| **SB 350** | State/California Energy Commission | Clean Energy and Pollution Reduction Act will enable transformation of energy production to zero-emission.<br><br>Primarily provides funding to public utilities to reduce GHG emissions.<br><br>Also supports transportation electrification by providing rebates of up to 50% of the electric vehicle supply equipment (chargers, etc.) for transit fleets. | OCTA may apply for this funding as soon as a practical to acquire necessary infrastructure. |
| **SB1 State of Good Repair** | State/Caltrans | SGR funds are formula-based funds eligible for transit maintenance, rehabs, and capital programs. | OCTA may apply for this funding opportunity as soon as practical to acquire necessary infrastructure. |
| **Charge Ready** | State/SCE | Charge Ready program aims to reduce the infrastructure cost for zero-emission vehicles.<br><br>Charge Ready can cover the cost for installation of the electric infrastructure as well as rebates for charging stations.<br><br>However, agencies must provide a grant of easement.<br><br>Funding is available until 2025 and receipts must acquire at least two BEBs within 18 months to receive the Charge Ready rebates.<br><br>Note, that Charge Ready is dedicated for EVs and electric buses—will not cover costs for hydrogen infrastructure. | OCTA may apply for this program as soon as practical to acquire necessary infrastructure. |
| **Low or No Emission Program (Low-No Program)** | Federal/FTA | Low-No provides competitive funding for the procurement of low or no emission vehicles, including the leasing or purchasing of vehicles and related supporting infrastructure.<br><br>FY20 application closes March 17, 2020, but this has been an annual program for the FTA (under the FAST Act). In FY19, ~$85 million was available.<br><br>This is a stipulation for a local match. | Based on federal budget adoption of a new transportation appropriations bill, it is likely a similar program will continue.<br><br>OCTA may apply for this program as soon as practical to acquire necessary infrastructure. |

| Fund/Grant | Level of government | Description | Applicability |
|---|---|---|---|
| **BUILD** | Federal/USDOT | Formerly TIGER, BUILD aims to support investment in infrastructure.<br><br>A local match is required. | OCTA may apply for this program as soon as practical to acquire necessary infrastructure. |
| **Buses and Bus Facilities Program (5339)** | Federal/FTA | These grants are competitive and formula-based and are applicable to rehabbing buses, purchase new buses, and invest and renovate related equipment and facilities for low or no emission vehicles or facilities.<br><br>For FY20, FTA announced ~$455 million in competitive grant funding.<br><br>Requires a 20% local match. The deadline for FY20 funding is March 30, 2020. | OCTA may apply for this program as soon as practical to acquire necessary infrastructure. |

# Section I: Start-up and Scale-up Challenges

*Please describe any major challenges your transit agency is currently facing in small scale zero-emission bus deployment.*

None at the moment. OCTA's current ZEB pilot projects are fully funded; however, OCTA's FCEB pilot project just began in January 2020 and the BEB pilot project is not expected to begin until 2023. Therefore, it is too early to assess maintenance cost and operational issues, compared to conventional fuel type buses.

*How might CARB assist you to overcome these challenges? Please share your recommendations*.

N/A

*Please describe any challenges your transit agency may face in scaling up zero-emission bus deployment.*

The transition to ZEB buses will have a substantial cost compared to OCTA continuing to operate existing fuel types. The per unit vehicle costs for ZEBs are higher and OCTA will need to install new fueling infrastructure at a significant cost. The draft ZEB Rollout Plan attempts to keep the lowest overall cost for OCTA through this transition. This is done by continuing to operate existing fuel technologies as long as allowable and implementing the lowest cost ZEB vehicles based on total cost of ownership. The costs for vehicles, fuel, and infrastructure may change over time. Breakthroughs in battery technology may make BEBs less expensive or a lower cost to produce hydrogen would make FCEBs less expensive. The plan proposed is based on what is currently known about each technology and their associated costs. This will help OCTA better understand the long-term cost and how it may impact the level of transit services which can be provided. It is also important to note that this Rollout Plan was developed prior to the COVID-19 emergency. The plan will need to be updated if transit service levels and fleet requirement are substantially changed in the future.

*How might CARB assist you to overcome these challenges?*

Expand and seek additional funding sources to help agencies meet the purchase requirement. CARB may also assist agencies by authorizing that incentive programs be available for the life of the ICT Regulation.

# Appendix – Resolution No. 2020-055

**RESOLUTION NO. 2020-055 OF THE BOARD OF DIRECTORS OF THE ORANGE COUNTY TRANSPORTATION AUTHORITY**

**ZERO-EMISSION BUS RULLOUT PLAN**

A RESOLUTION OF THE ORANGE COUNTY TRANSPORTATION AUTHORITY, WHICH AUTHORIZES THE SUBMITTAL OF THE ZERO-EMISSION BUS ROLLOUT PLAN TO THE CALIFORNIA AIR RESOUCES BOARD AS REQUIRED BY THE INNOVATIVE CLEAN TRANSIT REGULATION

WHEREAS, in 2018, the California Air Resources Board (CARB) adopted the Innovative Clean Transit (ICT) Regulation, which requires public transit agencies to transition to a 100 percent zero-emission bus (ZEB) fleet, such as battery-electric or fuel- cell electric, by 2040.

WHEREAS, the main provisions of the ICT regulation include:

- Transit agencies which operate a fleet larger than 65 buses are required to submit a ZEB Rollout Plan (Rollout Plan) by July 1, 2020,
- Transit agencies must purchase a minimum number of ZEBs during future procurements, according to the following schedule:
    - Starting in 2023, 25 percent of new bus purchases must be ZEBs (applies to 40-foot buses only),
    - Staring in 2026, 50 percent of all new bus purchases must be ZEBs (40-foot, 60-foot, and smaller "cutaway" buses typically used for paratransit service),
    - Starting in 2029, 100 percent of all new bus purchases must be ZEBs.
- Transit agencies can earn credits to offset the 2023 and 2026 ZEB purchase requirements by providing zero-emission vehicles not covered by the ICT regulation, and
- The minimum ZEB purchase requirement may be delayed if a certain number of ZEBs are purchased statewide by the end of 2020 and 2021.

WHEREAS, the ICT regulation requires each agency to submit a Rollout Plan to CARB by July 1, 2020.

WHERAS, the Rollout Plan is a living document intended to guide the agency's conversion to a ZEB fleet and may be updated based on changes in vehicle technology, fleet size, and operating requirements.

WHEREAS, the Rollout Plan must be approved by the transit agency's governing body through the adoption of a resolution prior to submission to CARB.

WHEREAS, per the requirements of the ICT, the Rollout Plan includes the following components:

- Type(s) of ZEB technologies a transit agency is planning to deploy,
- Schedule for all ZEB and conventional bus purchases,
- Schedule for infrastructure upgrades and modifications,
- Identification of costs and potential funding sources,
- Plan to deploy ZEBs in disadvantaged communities,
- Training plan for operators and maintenance staff, and
- Goal of full transition to ZEBs by 2040.

NOW, THEREFORE, BE IT RESOLVED that the Orange County Transportation Authority Board of Directors hereby adopts the Rollout Plan as a guide for the implementation of ZEB technology and approves it for submission to CARB.

PASSED, APPROVED AND ADOPTED this 22nd day of June.

AYES: Chairman Jones, Vice Chairman Do, and Directors Bartlett, Chaffee, Davies, Delgleize, Hennessey, Hernandez, Muller, Mark A. Murphy, Richard Murphy, Pulido, Shaw, Sidhu, Steel, Wagner, and Winterbottom

NOES: None

ABSENT: None

ATTEST:

Laurena Weinert
Clerk of the Board

Steve Jones, Chairman
Orange County Transportation Authority