

Appendix A – ZEB Rollout Plan



Zero-Emission Bus Rollout Plan

September 2020

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Section A: Transit Agency Information

1. **Transit agency's name (required)**
San Diego Metropolitan Transit System (MTS)
2. **Mailing address (number, street, city, county, Zip Code) (optional)**
1255 Imperial Avenue, San Diego, CA 92101
3. **Name of transit agency's air district(s) (optional)**
San Diego County Air Pollution Control District
4. **Name of transit agency's air basin(s) (optional)**
San Diego Air Basin
5. **Total number of buses in Annual Maximum Service (optional)**
823 buses
6. **Population of the urbanized area a transit agency is serving as last published by the Census Bureau before December 31, 2017 (optional)**
Population = 3,000,000 for service area
7. **Contact information of the general manager, chief operating officer, or equivalent (optional)**
 - a. *Wygant, Michael*
 - b. *Chief Operating Officer*
 - c. *(619) 238-0100 ext. 6400*
 - d. Michael.Wygant@sdmts.com
8. **Is your transit agency part of a Joint Group5 (13 CCR § 2023.1(d)(3))? (Yes/No) (required)**
No

Section B: Rollout Plan General Information

1. **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 (13 CCR § 2023.1(d)(1)(A))? (Yes/No) (required)**

No, MTS transition analysis does not indicate that 100% can be completed by 2040 based on our technological advancement assumption (every two years 5% energy density increase for battery technology) by 2040 with depot charging. MTS estimates 94% of the fleet blocks scheduled could be operated by battery electric technology, with depot charging only and fuel cell, with hydrogen fueling. (breakdown by bus type below).

*Additionally, outlined in the MTS fleet replacement plan, there are a small amount of buses indicated that cannot be replaced with ZEBs because of range limitation at the end of their service life during the transition. Our analysis range assumptions include a 5% improvement every other year throughout the transition. This limitation results in a few vehicles being replaced just after 2040 based on that limitation. **If technology advances faster than the***

technological advancement assumption (5% every other year), MTS is committed to procure zero emission buses at an advanced rate depending on funding and availability to meet the 100% fleet transition by 2040.

Bus type - Block schedules (%) that electric bus technology can meet by 2040:*

- *Cutaway (32' Buses) = 45% by 2040*
- *40' Buses = 94% by 2040*
- *45' Buses (Coaches) = 100% by 2040*
- *60' Buses (Artics) = 76% by 2040*

With the adding fuel cell vehicles in the Mixed Fleet scenario, MTS transition will meet 94% at 2040 and 100% in 2042. **If technology advances faster than the technological advancement assumption (5% every other year), MTS is committed to procure zero emission buses at an advanced rate depending on funding and availability to meet the 100% fleet transition by 2040.*

2. **The ICT regulation requires 100% ZEB purchase 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. (optional)** *MTS intends to purchase vehicle at or ahead of the purchasing mandate, allowing for vehicles complete their minimal lifecycle ahead of the 2040 goal assuming infrastructure, range and funding is available. There may be a small amount of vehicles that are not replaced prior to 2040 based on service life and OEM construction schedules.*
3. **When did your transit agency's board or governing body approve the Rollout Plan?**
 - a. Board Approval Date? *06/18/2020*
 - b. Resolution #? (optional) *Tentative 9/17/20*
 - c. Is a copy of the board approved resolution attached to the Rollout Plan submitted to CARB (13 CCR § 2023.1(d)(2))? (Yes/No) (required)
4. **Please provide contact information for CARB to follow up on details of the Rollout Plan, if needed. (optional)**
 - a. *Kyle Whatley*
 - b. *Zero Emissions Project Specialist*
 - c. *619-446-4046*
 - d. Kyle.whatley@sdmts.com
5. **Who has created the Rollout Plan? (transit agency / consultant) (optional)**

San Diego Metropolitan Transit System (MTS)/Center for Transportation & Environment (CTE)

 - a. **If it was created by a consultant, please identify the consulting company's name.**

CTE created MTS's Transition Plan (attached) that is a guidance document for transitioning fleet to 100% zero-emission fleet.
6. **What was the cost for the creation of the Rollout Plan? (optional)**

This includes, Center for Transportation & Environment consulting cost for MTS's battery electric bus pilot deployment (data collected from the pilot supports direction of the Transition Plan) and the main objective to develop a roadmap/transition plan for MTS.

- CTE cost - \$497,951
- MTS Staff – \$182,458

7. How many person-hours did it take to create the Rollout Plan? (optional)

- CTE hours – 3,438
- MTS hours – 3,304

Section C: Technology Portfolio

1. 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? (13 CCR § 2023.1(d)(1)(B)) (required)

MTS plans to deploy battery electric bus and fuel cell technology with depot charging only, and hydrogen station. With our initial analysis and assumption of 5% technological advancement only 94% blocks will be met by 2040.

Bus type - Block schedules (%) that electric bus technology can meet by 2040:*

- Cutaway (32' Buses) = **45%** by 2040
- 40' Buses = **94%** by 2040
- 45' Buses (Coaches) = **100%**
- 60' Buses (Artics) = **76%** by 2040

With the adding fuel cell vehicles in the Mixed Fleet scenario, MTS transition will meet 94% at 2040 and 100% in 2042. **If technology advances faster than the technological advancement assumption (5% every other year), MTS is committed to procure zero emission buses at an advanced rate depending on funding and availability to meet the 100% fleet transition by 2040.*

Section D: Current Bus Fleet Composition and Future Bus Purchases

- 1. 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. For zero-emission technologies, identify the fuel type as hydrogen or electricity and indicate which charging technology (depot, wireless, and/or on-route) will be used. Bus types include standard, articulated, over-the-road, double decker, and cutaway buses. For ease of use, you can group the bus information based on a parameter that makes the most sense for your transit agency. For example, California-Heritage Transit has 12 standard diesel buses that are 2017 bus model year with 2016 model year engines. In addition, this transit**

agency has 3 articulated diesel buses that are 2011 bus model year with 2010 model year engine. (optional)

Table 1: Individual Bus Information of Current Bus Fleet (optional)

Number of Buses	Engine Model Year	Bus Model Year	Fuel Type	Bus Type
23	2015	2015	CNG	Standard 40'
50	2008	2008	CNG	Standard 40'
7	2005	2005	CNG	Standard 40'
26	2011	2011	CNG	Standard 40'
31	2012	2012	CNG	Standard 40'
26	2013	2013	CNG	Standard 40'
12	2014	2014	CNG	Standard 40'
26	2008	2008	CNG	Artic 60'
29	2013	2013	CNG	Rapid Artic 60'
18	2014	2014	CNG	Rapid Artic 60'
13	2015	2015	CNG	Artic 60'
10	2017	2017	CNG	Standard 40'
14	2015	2015	CNG	Standard 40'
36	2017	2017	CNG	Standard 40'
15	2013	2013	CNG	Standard 40'
38	2015	2015	CNG	Standard 40'
7	2018	2018	CNG	Standard 40'
73	2009	2009	CNG	Standard 40'
22	2012	2012	CNG	Standard 40'
5	2008	2008	CNG	Standard 40'
2	2009	2009	CNG	Standard 40'
10	2017	2017	CNG	Artic 60'
17	2018	2018	CNG	Rapid Artic 60'
9	2013	2013	CNG	Standard 40'
6	2019	2019	CNG	Standard 40'
13	2015	2015	CNG	Standard 40'
38	2016	2016	CNG	Standard 40'
24	2007	2007	CNG	Coach 45'
3	2018	2018	Gasoline	Cutaway
31	2016	2016	LPG	Cutaway
6	2013	2013	Gasoline	Cutaway
26	2011	2011	LPG	Cutaway
46	2012	2012	LPG	Cutaway
3	2012	2012	Gasoline	Cutaway
3	2014	2014	Gasoline	Cutaway
37	2015	2015	Gasoline	Cutaway
55	2016	2016	Gasoline	Cutaway
5	2015	2015	Gasoline	Cutaway
6	2019	2019	Electric	Standard 40'
2	2020	2020	Electric	Standard 40'

TOTAL = 823				
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2. Please complete Table 2 regarding expected future bus purchases,⁶ including the number of buses in total expected to be purchased or leased in the year of purchase. Identify the number and percentage of zero-emission buses 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, please identify the fuel type as hydrogen or electricity indicate which charging technology (depot, wireless, and/or on-route). For conventional technologies, identify the fuel type as diesel, compressed natural gas (CNG), liquefied natural gas (LNG), diesel hybrid (dHEB), gasoline hybrid (gHEB), propane, or gasoline.

Table 2: Future Bus Purchases (required)

Timeline (year)	Total Number of Buses to Purchase	Number of ZEB Purchases	% of Annual ZEB Purchases / % of ZEB Purchases Applicable to ICT Rule before 2026	ZEB Bus Type(s)	ZEB Fuel Type(s)	Number of Conv. Bus Purchases	% of Annual Conv. Bus Purchases	Type(s) of Conv. Buses	Fuel Type(s) of Conv. Buses
2020	88	2	2% / 4%*	Standard	Elec – Depot	50 36	98%	Standard Cutaway	CNG Propane
2021	82	5	6% / 12%*	Standard	Elec – Depot	37 13 27	94%	Standard Artic Cutaway	CNG CNG Propane
2022	89	12	13% / 32%*	Artic	Elec – Depot	38 26 13	87%	Standard Cutaway Artic	CNG Propane CNG
2023	66	11	17% / 27%*	Standard	Elec – Depot	30 25	83%	Standard Cutaway	CNG Propane
2024	104	10	10% / 26%*	Standard	Elec – Depot	28 66	74%	Standard Cutaway	CNG Propane
2025	106	13	12% / 26%*	Standard	Elec – Depot	37 18 35 3	88%	Standard Artic Cutaway Cutaway	CNG CNG Propane Gas
2026	115	28 15 15	50%	Standard Artic Cutaway	Elec – Depot Elec – Depot Hydrogen	22 14 21	50%	Standard Artic Cutaway	CNG CNG Propane
2027	87	27 17	51%	Standard Artic	Elec – Depot Elec – Depot	16 27	49%	Standard Cutaway	CNG Propane

2028	51	13 13	51%	Standard Cutaway	Elec – Depot Elec – Depot	12 13	49%	Standard Cutaway	CNG Propane
2029	58	15 5 13 25	100%	Standard Standard Artic Cutaway	Elec – Depot Hydrogen Elec – Depot Hydrogen	0	0%	NA	NA
2030	85	50 35	100%	Standard Cutaway	Elec – Depot Hydrogen	0	0%	NA	NA
2031	97	6 25 62 4	100%	Standard OTR Cutaway Cutaway	Elec – Depot Elec – Depot Elec – Depot Hydrogen	0	0%	NA	NA
2032	100	57 10 33	100%	Standard Artic Cutaway	Elec – Depot Elec – Depot Hydrogen	0	0%	NA	NA
2033	64	37	58%	Standard	Elec – Depot	27	**42%	Cutaway	Propane
2034	82	38 12 11 21	100%	Standard Artic Cutaway Cutaway	Elec – Depot Elec – Depot Elec – Depot Hydrogen	0	0%	NA	NA
2035	66	41 25	100%	Standard Cutaway	Elec – Depot Hydrogen	0	0%	NA	NA
2036	117	38 13 31 35	100%	Standard Artic Cutaway Cutaway	Elec – Depot Elec – Depot Elec – Depot Hydrogen	0	0%	NA	NA
2037	116	37 13 18 13 31 4	100%	Standard Standard Artic Artic Cutaway Cutaway	Elec – Depot Hydrogen Elec – Depot Hydrogen Elec – Depot Hydrogen	0	0%	NA	NA
2038	83	43 7 33	100%	Standard Standard Cutaway	Elec – Depot Hydrogen Hydrogen	0	0%	NA	NA
2039	87	39 17 4	69%	Standard Artic Standard	Elec – Depot Elec – Depot Hydrogen	27	**31%	Cutaway	Propane
2040	51	25 21 5	100%	Standard Cutaway Cutaway	Elec – Depot Elec – Depot Hydrogen	0	0%	NA	NA

*Denotes that percentage of ZEBs based on vehicles that have not been exempted from purchase requirements prior to 2026 (Standard vehicles only)

** Additionally, outlined in the MTS fleet replacement plan, there are a small amount of buses indicated that cannot be replaced with ZEBs because of range limitation at the end of their service life during the transition. Our analysis range assumptions include a 5% improvement every other year throughout the transition. This limitation results in a few vehicles being replaced just after 2040 based on that limitation.

If technology advances faster than the technological advancement assumption (5% every other year), MTS is committed to procure zero emission buses at an advanced rate depending on funding and availability to meet the 100% fleet transition by 2040.

Table 3: Range and Estimated Costs of Future ZEB Purchases (optional)

Timeline (Year)	Number of ZEBs	Bus Type(s)	Required BEB Range on-board H2 Storage	Estimated Cost of Each Bus
2020	2	Standard – Elec	450 kwh	\$950,000
2021	5	Standard – Elec	450 kwh	\$950,000
2022	12	Artic – Elec	473 kWh	\$1,375,000
2023	11	Standard – Elec	496 kWh	\$950,000
2024	10	Standard – Elec	521 kWh	\$950,000
2025	13	Standard – Elec	521 kWh	\$950,000
2026	28	Standard - Elec	547 kWh	\$950,000
	15	Artic - Elec	547 kWh	\$1,375,000
	15	Cutaway – Elec	122 kWh	\$250,000
2027	27	Standard - Elec	547 kWh	\$950,000
	17	Artic – Elec	547 kWh	\$1,375,000
2028	13	Standard - Elec	574 kWh	\$950,000
	13	Cutaway – Elec	128 kWh	\$250,000
2029	15	Standard - Elec	574 kWh	\$950,000
	5	Standard - Hyd	43 kg	\$1,150,000
	13	Artic - Elec	574 kWh	\$1,375,000
	25	Cutaway - Hyd	22 kg	\$375,000
2030	50	Standard - Elec	603 kWh	\$950,000
	35	Cutaway – Hyd	23 kg	\$375,000
2031	6	Standard - Elec	603 kWh	\$950,000
	25	OTR - Elec	603 kWh	\$950,000
	62	Cutaway - Elec	134 kWh	\$250,000
	4	Cutaway – Hyd	23 kg	\$375,000
2032	57	Standard - Elec	633 kWh	\$950,000
	10	Artic - Elec	633 kWh	\$1,375,000
	33	Cutaway - Hyd	25 kg	\$375,000
2033	37	Standard – Elec	633 kWh	\$950,000
2034	38	Standard - Elec	665 kWh	\$950,000
	12	Artic - Elec	665 kWh	\$1,375,000
	11	Cutaway - Elec	148 kWh	\$250,000
	21	Cutaway – Hyd	26 kg	\$375,000
2035	41	Standard - Elec	665 kWh	\$950,000
	25	Cutaway – Hyd	26 kg	\$375,000
2036	38	Standard - Elec	698 kWh	\$950,000
	13	Artic - Elec	698 kWh	\$1,375,000
	31	Cutaway - Elec	155 kWh	\$250,000

	35	Cutaway – Hyd	27 kg	\$375,000
2037	37	Standard - Elec	698 kWh	\$950,000
	13	Standard - Hyd	53 kg	\$1,150,000
	18	Artic - Elec	698 kWh	\$1,375,000
	13	Artic - Hyd	86 kg	\$1,632,000
	31	Cutaway - Elec	155 kWh	\$250,000
	4	Cutaway – Hyd	27 kg	\$375,000
2038	43	Standard - Elec	733 kWh	\$950,000
	7	Standard - Hyd	56 kg	\$1,150,000
	33	Cutaway – Hyd	29 kg	\$375,000
2039	39	Standard - Elec	733 kWh	\$950,000
	17	Artic - Elec	733 kWh	\$1,375,000
	4	Standard – Hyd	56 kg	\$1,150,000
2040	25	Standard - Elec	770 kWh	\$950,000
	21	Cutaway - Elec	171 kWh	\$250,000
	5	Cutaway – Hyd	30 kg	\$375,000

3. Is your transit agency considering converting some of the conventional buses in service to zero-emission buses (13 CCR § 2023.1(d)(1)(E))? (Yes/No) (required)

No, not at this time.

- a. If yes, please complete Table 4a with your transit agency’s schedule to convert the conventional buses to zero-emission technologies. (required)
- b. Please identify the estimated cost of converting each bus, the required battery capacity or on-board hydrogen storage, and the estimated range in Table 4b. (optional) N/A

Table 4a: Schedule of Converting Conventional Buses to Zero-Emission Buses (required) N/A

Timeline (Year)	Number of Buses	Bus Type(s)	Removed Propulsion System	New Propulsion System

Table 4b 1: Range and Estimated Costs for Converting Conventional Buses to Zero- Emission Buses (optional) N/A

Estimated Cost per Bus	Battery Capacity/ H2 Storage	Range

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. Please identify which facility(s) require construction, infrastructure modifications, or upgrades to support your transit agency’s long-term transition to zero-emission technologies and the estimated timeline for such an upgrade. Please also specify the type(s) of infrastructure planned in each division or facility and provide their service capacities (e.g. on-route high-power charging system) to deploy 20 BEB in 2025). (required)

Table 5: Facilities Information and Construction Timeline (required)

Division/Facility Name	Address	Main Function(s)	Type(s) of Infrastructure	Service Capacity	Needs Upgrade (Yes/No)	Estimated Construction Timeline
<i>Imperial Avenue</i>	<i>100 16th Street, San Diego, CA 92101</i>	<i>Operations, Maintenance, Fueling/Charging, Cleaning</i>	<i>Maintenance Bays, Fuel Service Lanes, CNG Station, Electric Chargers, Bus Wash</i>	<i>170</i>	<i>Yes</i>	<i>2021 – 2023 2023 – 2025 2025 - 2027 2027 - 2029 2030 – 2032 2033 – 2036</i>
<i>Kearny Mesa</i>	<i>4630 Ruffner rd. San Diego, CA 92111</i>	<i>Operations, Maintenance, Fueling/Charging, Cleaning</i>	<i>Maintenance Bays, Fuel Service Lanes, CNG Station, Electric Chargers, Bus Wash</i>	<i>100</i>	<i>Yes</i>	<i>2024 – 2026 2025 – 2027 2035 - 2037</i>
<i>East County</i>	<i>544 Vernon Way El Cajon, CA 92020</i>	<i>Operations, Maintenance, Fueling/Charging, Cleaning</i>	<i>Maintenance Bays, Fuel Service Lanes, CNG Station, Electric Chargers, Bus Wash</i>	<i>88</i>	<i>Yes</i>	<i>2025 – 2028 2028 – 2030</i>
<i>South Bay</i>	<i>3650 Main St Chula Vista, CA 91911</i>	<i>Operations, Maintenance, Fueling/Charging, Cleaning</i>	<i>Maintenance Bays, Fuel Service Lanes, CNG Station, Electric Chargers, Bus Wash</i>	<i>239</i>	<i>Yes</i>	<i>2020 – 2022 2022 – 2024 2023 – 2025 2024 – 2026 2025 – 2027 2027 – 2029 2028 – 2030 2031 - 2033</i>
<i>Copley</i>	<i>7490</i>	<i>Operations,</i>	<i>Maintenance</i>	<i>178</i>	<i>Yes</i>	<i>2024 – 2026</i>

	Copley Park Pl San Diego, CA 92111	Maintenance, Fueling Cleaning	Bays, Fuel Service Lanes, CNG Station, Electric Chargers, Bus Wash			2025 – 2027 2027 – 2028 2028 – 2030 2030 – 2032 2032 – 2035 2035 – 2037 2037 - 2039
New Facility						

- Regarding the information provided in Table 5, please explain the types of necessary upgrades or infrastructure modifications each facility or division need to support your transit agency’s long-term transition to ZEB. Please also provide the specification of each infrastructure in the related facility or division before and after the upgrades or modifications. For example, Division Blue Sky has a parking capacity of 150 buses in 2020. In 2025, after parking rearrangement and installation of 30 depot fast chargers with power of 150 kW, this facility is expected to accommodate 120 buses; or Division Enchanting Waterfalls will deploy 20 fuel cell electric buses (FCEBs) in 2025 with trucked-in liquid hydrogen for 1,500 kg of storage capacity and will expand to 120 FCEBs in 2035 with trucked-in liquid hydrogen for 9,000 kg of storage capacity; or Division Evergreen will deploy 20 BEBs in 2025 using an on-route high-power charging system (500 kW) with 10 chargers and will expand to 200 BEBs in 2040 using the same charging method with 15 MW of on-site power. (optional)**

 - Imperial Avenue Division: has a bus capacity of 154 buses in 2020. In 2040, after installation of approximately 19 overhead gantry systems and approximately 80 depot fast chargers with at least 150 kW rate of charge, this facility is expected to accommodate 129 ZEBs based on route block schedules this technology can meet. In addition, 3 new locations for utility transformers will need to be installed on-site to accommodate power demand for charging infrastructure.*
 - Kearny Mesa Division: has as a capacity of 127 buses in 2020. In 2040, after installation of approximately 15 overhead gantry systems, and approximately 50 depot fast chargers with at least 150 kW rate of charger, this facility is expected to accommodate 98 ZEBs based on route block schedules that this technology can meet . In addition, 5 new locations for utility transformers will need to be installed on-site to accommodate power demand for charging infrastructure.*
 - East County Division: has as a capacity of 77 buses in 2020. In 2040, after installation of approximately 11 overhead gantry systems, and approximately 31 depot fast chargers with at least 150 kW rate of charger, this facility is expected to accommodate 71 ZEBs based on route block schedules that this technology can meet. In addition, 5 new locations for utility transformers will need to be installed on-site to accommodate power demand for charging infrastructure.*
 - South Bay Division: has as a capacity of 260 buses in 2020. In 2040, after installation of approximately 37 overhead gantry systems, and approximately 104 depot fast chargers*

with at least 150 kW rate of charger, this facility is expected to accommodate 253 ZEBs based on route block schedules that this technology can meet. In addition, 6 new locations for utility transformers will need to be installed on-site to accommodate power demand for charging infrastructure.

- *Copley Division: has as a capacity of 260 buses in 2020. In 2040, after installation of approximately 37 overhead gantry systems, and approximately 104 depot fast chargers with at least 150 kW rate of charger, this facility is expected to accommodate 253 ZEBs based on route block schedules that this technology can meet. In addition, 6 new locations for utility transformers will need to be installed on-site to accommodate power demand for charging infrastructure.*
- *New Facility: will have at least a similar capacity as the South Bay division.*

- **Do you expect to make any modifications to your bus parking arrangements? Explain the modifications and why they are needed. (optional)** *Yes, the following divisions include:*

- *Imperial Avenue Division: with 19 overhead gantry systems installed, and 6 islands that will secure the gantry foundations and potentially charger equipment, the bus parking arrangement will change by adding 27 bus parking spots where it is existing bus operator parking stalls to accommodate charger equipment installation including gantry system.*
- *Kearny Mesa Division: with 15 overhead gantry systems installed, 8 islands that will secure the gantry foundation and potentially charger equipment, the bus parking arrangement could lose approximately 8 bus parking stalls to accommodate charger equipment installation including gantry system.*
- *East County Division: with 11 overhead gantry systems installed, and 3 islands that will secure the gantry foundations and potentially charger equipment, the bus parking arrangement could lose approximately 5 Coach 45' bus parking spots, and 6 standard 40' bus parking spots, where it is existing bus operator parking stalls to accommodate charger equipment installation including gantry system.*
- *South Bay Division: with 37 overhead gantry systems installed, and 10 islands that will secure the gantry foundations and potentially charger equipment, the bus parking arrangement will change by approximately adding 47 bus parking spots where it is an existing building structure today, that would need to be demolished in order to accommodate the additional bus parking spaces.*
- *New Facility: will have a similar capacity as the South Bay division.*

- **Do you expect to need additional parking spaces for completing the transition to zero-emission technologies? Explain why. (optional)**

Yes, with overhead gantry systems, charger equipment, and utility equipment installed, at least 2 sites (Imperial Ave & South Bay Divisions) will need to add additional parking to accommodate a battery electric bus fleet at those two sites.

- **In the Table 6, please identify the propulsion system (e.g. diesel, CNG, battery electric, fuel cell) of all buses that will be dispatched from the facilities identified on the Table 5. Are any of these facilities located in NOx-exempt areas? (optional)**
As of today.

Table 6: NOx-Exempt Area and Electric Utilities’ Territories (optional)

Division’s Name	Type(s) of Bus Propulsion System	Located in NOx-Exempt Area? (Yes/No)
<i>Imperial Avenue Division</i>	<i>Low NOx combustion engine (RNG) & transmission, traction motor</i>	<i>No</i>
<i>Kearny Mesa Division</i>	<i>Low NOx combustion engine (RNG) & transmission</i>	<i>No</i>
<i>East County Division</i>	<i>Low NOx combustion engine (RNG), diesel combustion engine, gasoline combustion engine & transmission</i>	<i>No</i>
<i>South Bay Division</i>	<i>Low NOx combustion engine (RNG) & transmission</i>	<i>No</i>
<i>Copley Division</i>	<i>Liquid propane combustion engine, gasoline combustion engine & transmission</i>	<i>No</i>

6. Please identify the electric utilities in your transit agency’s service area (optional)

San Diego Gas & Electric

Section F: Providing Service in Disadvantaged Communities

1. Does your transit agency serve one or more disadvantaged communities, as listed in the latest version of CalEnviroScreen? Yes/ No (required)

Yes. Per the June 2018 update to CalEnviroScreen, all of the SB 535 Disadvantaged Communities Census tracts (DACs) in San Diego County are located within the MTS service area. MTS provides either bus transit service, zero-emission all-electric light rail transit service, or both to every DAC within our service area.

If yes, please describe how your transit agency is planning to deploy zero-emission buses in disadvantaged communities (13 CCR § 2023.1(d)(1)(F)). (required)

MTS plans to prioritize deployment of BEBs in DACs during the fleet conversion years. We currently operate full-size (40'-60') buses out of four divisions. As a primary step, MTS must install charging infrastructure for electric buses in each of these divisions. Electrification will happen in phases by division, due to available funding, optimized fleet management and maintenance, and to incorporate progressive infrastructure improvements with each installation. Implementation of the charging equipment will be prioritized based on the amount of service provided to DACs that operates out of each division, in order to ensure availability of BEBs on routes in these tracts. An analysis showed that the South Bay Division operates the most service in DAC communities, as measured by number of routes or number of passengers served. Any other metrics are expected to follow a similar pattern:

<u>40'/60' Bus Division</u>	<u>% of Routes Serving DACs</u>	<u>% of Riders on Routes Serving DACs</u>
South Bay Division	69%	56%
Imperial Ave./Kearny Mesa Divisions	58%	16%
East County Division	41%	10%

Imperial Ave. and Kearny Mesa divisions are combined because a large number of their routes are operated from both divisions simultaneously. This analysis included any route with at least one stop in a DAC to be a "DAC-serving route" but a methodology that includes only routes with a certain number of stops in a DAC, or percentage of riders originating in a DAC, could also be used. MTS expects the relative results among the three locations would be the same. Based on this information, MTS intends to prioritize installation of electrical charging infrastructure at the four full-size bus divisions as follows:

1. South Bay
2. Imperial Ave.
3. Kearny Mesa
4. East County

Following the installation of charging infrastructure at each division, the daily bus assignments will prioritize the deployment of BEBs on to routes serving DACs within each division. The MTS Planning Department will keep its operations divisions updated with a current list of DAC-serving routes, as the routes (and CalEnviroscreen itself) will be updated and adjusted over time. Buses are assigned to individual blocks on a daily basis by the maintenance and operations teams at the division. Each facility will have ready lanes specific to BEBs (versus mixed-parking) so that a BEB can always be pulled independently to fill a DAC-serving block. Bus assignments by power type (BEB and natural gas) will be recorded and regularly made available to the public for transparency and accountability.

Aside from which bus routes serve DACs, there are other issues considered for assigning BEBs. These include range limitations (versus block lengths) and the bus size needed and available (40' or 60'). Also, many blocks are interlined for efficiency and include routes that serve DACs and routes that don't serve DACs. Lastly, unplanned events require some flexibility, and standby buses may be either BEB or natural

gas, depending on availability at the time of assignment. Note also that MTS received a California Transit and Intercity Rail Capital Program (TIRCP) grant for the implementation of a new MTS Rapid route, Iris Rapid, for which the state is requiring the purchase and use of BEBs. These new BEBs will be dedicated to Iris Rapid, though it does not serve any SB 535 DACs. However, the route still serves several areas that are communities of concern due to population characteristics and economic burdens.

In summary, MTS will:

- Utilize CalEnviroscreen to identify SB 535 communities disadvantaged by high pollution burden and vulnerable population characteristics
- Identify bus routes serving SB 535 DACs and prioritize charging infrastructure to serve these routes
- Prioritize bus assignments on routes serving SB 535 DACs during fleet transition years

Please complete **Table 7** with the estimated number of zero-emission buses your transit agency is planning to deploy in disadvantaged communities and the estimated timeline.

Table 7: Service in Disadvantaged Communities (DAC) (optional)

Timeline (Year)	Number of ZEBs	Location of DAC
2020	8	6073002501, 6073002502, 6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2021	8	6073002501, 6073002502, 6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601,

		<p>6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000</p>
2022	8	<p>6073002501, 6073002502, 6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000</p>
2023	11	<p>6073002501, 6073002502, 6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009,</p>

		6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2024	10	6073002501, 6073002502, 6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2025	13	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2026	58	6073003301, 6073003303, 6073003305, 6073003403,

		<p>6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000</p>
2027	44	<p>6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000</p>
2028	34	<p>6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009,</p>

		6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2029	68	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2030	115	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2031	69	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501,

		<p>6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000</p>
2032	103	<p>6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000</p>
2033	37	<p>6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602,</p>

		6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2034	76	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2035	66	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2036	117	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601,

		6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2037	119	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2038	86	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801,

		6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2039	60	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000
2040	51	6073003301, 6073003303, 6073003305, 6073003403, 6073003404, 6073003501, 6073003502, 6073003601, 6073003602, 6073003603, 6073003800, 6073003901, 6073003902, 6073004000, 6073004100, 6073004700, 6073004800, 6073004900, 6073005000, 6073005100, 6073005200, 6073005300, 6073005700, 6073010009, 6073011601, 6073011602, 6073011700, 6073011801, 6073012501, 6073012502, 6073012600, 6073013205, 6073015901, 6073016202, 6073021900, 6073022000

Section G: Workforce Training

Please describe your transit agency's plan and schedule for the training of bus operators and maintenance and repair staff on zero-emission bus technologies (13 CCR § 2023.1(d)(1)(G)). (required)

CARB Regulation (13 CCR § 2023.1(d)(1)(G) Requirements:

Describe transit agency's plan and schedule for the training of bus operators, maintenance and repair staff on zero-emission bus technologies

Training

Initial training is provided by bus manufacturers and sub-contractors and commences once first bus arrives. Bus manufacturer training is usually one week, and depending on how many sub-contractor manufacturers there are it can take another 2 weeks for this training. Typically, each OEM is required to provide no less than 80 hours or vehicle specific training. This training is focused on safety, familiarity and basic trouble shooting. All training for employees will be scheduled in advance of vehicle deliveries or the necessary repairs where practicable in order to avoid a safety issue or slowdown of work for our employees during the transition.

- *With Zero Emission Bus (ZEB) purchases, MTS requires an additional, 80 hours of training for a total of 160 hours to cover the additional complexities of the vehicles*
- *Because of the limited ZEB's during the start of the transition, initially a focused group of trained MTS employees will be performing the scheduled and unscheduled maintenance on the ZEB's*
- *As the fleet grows, work will be expanded to the complete work force after they have completed the training and certifications*

MTS currently has a California State Accredited training program to develop mechanics. The program is administered by MTS's two (2) fulltime trainers and a local community college. The program was developed in partnership with the International Brotherhood of Electrical Workers (IBEW). This program is administered over a four (4) year period moving from apprentices or entry level mechanics to Journeyman. MTS is integrating ZEB technology into this program. The program will not only cover the safety, familiarity and basic trouble shooting, but also more in-depth procedures and troubleshooting.

ZEB specific training modules include:

- *High-voltage safety*
- *Personal protective equipment (PPE)*
- *EV major component familiarization*
- *Power conversion*
- *Inverters*

- *Drive and traction motors*
- *Battery systems*
- *Preventative maintenance inspection procedure*
- *Charging familiarization and troubleshooting*

In addition to MTS maintenance staff training, non-maintenance employees receive ZEB specific training as outlined below:

- *Bus operator training includes, electric bus familiarization; regenerative braking technique; high voltage safety & personal protective equipment*
- *New hire bus operator orientation programs include the BEB training module, as well as reemphasized during the annual verification of transit training (VTT) program*

— *Bus Operators:*

Prior to MTS bus operators operating a ZEB, they must successfully accomplish the following additional training requirements, which are also reemphasized during the annual VTT program:

- *Electric bus familiarization; regenerative braking technique; high voltage safety & personal protective equipment*

Once MTS constructs the proposed overhead charging system, bus operators will also be trained on the associated process and procedures to safely park and secure the vehicle in preparation for charging.

— *Facilities Maintenance Staff and Maintenance:*

- *Electrical Safety, basic visual charging system inspections as required for FTA assets (preventive maintenance and repairs will be performed by OEM)*

— *First Responders (Local Police & Fire Agencies):*

- *High voltage safety, personal protective equipment (PPE) and bus familiarization*

— *Tow Truck Service Providers:*

- *High voltage safety, PPE, and bus familiarization*

— *Body Repair Technicians:*

- *High voltage safety, PPE, and bus familiarization*

- *Instructors/Trainers:*
 - *Bus Operations Training and Instruction staff receive OEM operations, high voltage safety, including PPE, bus familiarization, and regenerative braking technique*
 - *Maintenance Training Staff will receive all OEM training including, high voltage safety, PPE, bus & EV major component familiarization, and charger familiarization & troubleshooting*

- *Service Attendants*
 - *Knowledge of proper charging and servicing protocols and procedures that are ZEB-specific, and receive high voltage safety/PPE*

- *Fleet Management Staff*
 - *All staff (Foreman/Division Managers) will be familiarized with ZEB operations and safety procedures, high voltage safety, PPE, bus & EV major component familiarization, and charger familiarization*

- *Quality Assurance Department*
 - *Staff will receive all OEM training including high voltage safety, PPE, bus & EV major component familiarization, regenerative braking technique, BEB operations, and charger familiarization & troubleshooting*

Facility (Charging Systems)

- *Infrastructure Construction, Installation and Maintenance*
 - *Unless performed by employees of the local regulated investor-owned utility, all construction and installation of electric vehicle chargers and supporting charging infrastructure not owned by the investor-owned utility, shall be performed by Licensed C-10 Electrical Contractors and electricians who have Electric Vehicle Infrastructure Training Program (EVITP) certification and who shall be paid the prevailing wage as defined in Labor Code section 1720, et seq.*
 - *Unless performed by employees of the local regulated investor-owned utility, all maintenance, repair or modification of electric vehicle chargers and supporting charging infrastructure not owned by the investor-owned utility, shall be performed by Licensed C-10 Electrical Contractors and electricians who have Electric Vehicle Infrastructure Training Program (EVITP) certification and who shall be paid the prevailing wage as defined in Labor Code section 1720, et seq.*
 - *These requirements apply to work included in Construction Specifications Institute (CSI) Format Division 26 – Electrical (exhibit A) and to work covered in the EVITP curriculum that relates to the construction, installation and maintenance of electric*

vehicle chargers and supporting charging infrastructure. All other CSI divisions are exempt. CSI Format Divisions are provided as Exhibit A to this plan.

- *Exempt from these requirements are maintenance, repair or modifications to the charging station software/firmware performed by the Original Equipment Manufacturer (OEM) or a certified OEM vendor.*

Vehicle Maintenance

- *Currently MTS performs the vast majority of scheduled and unscheduled vehicle repairs with a combination of in-house and contracted union-represented employees. MTS intends to continue this practice for all routine maintenance and repairs for ZEB vehicles.*
- *Curriculums of joint apprenticeship training programs will be updated to train apprentices on new ZEB technology, consistent with past practice.*
- *Currently there are a limited amount of systems and subsystems that are not repaired by in-house or contracted employees due to technical capacity, parts availability, workload capacity and warranty provisions, among other reasons.*
 - *The systems typically not repaired by staff, include but are not limited to: engines, transmissions, pumps, electric motors and controllers*
 - *MTS intends to continue the practice of contracting out repairs when necessary with ZEB vehicles, to include but not limited to battery overhaul or repair, traction motor overhaul, Battery Management System overhaul or repair and drive motor overhaul or repair*
 - *MTS expectation is in-house or contracted staff will be required to trouble shoot, remove and replace these types of systems and subsystems when there is no warranty exclusion or technical capacity prohibiting it, as they do today.*
 - *In the event of reduced labor hours as a result of the ZEB transition, MTS will endeavor to use in-house union-represented employees to perform repairs of the systems not typically maintained by in-house staff, including but not limited to: engines, transmissions, pumps, electric motors controllers, battery overhaul or repair, traction motor overhaul, Battery Management System overhaul or repair and drive motor overhaul or repair when economically feasible and operationally prudent.*
 - *If the introduction of the ZEB technology leads to a reduction in union represented mechanics or maintenance employees, MTS will meet with the relevant union over the potential for job re-training in order to prevent or reduce layoffs, in accordance with terms of relevant collective bargaining agreements.*

EXHIBIT A: MASTERSPEC – Construction Specification Institute (CSI)

Please complete Table 8. (optional)

Table 8: Workforce Training Schedule (optional)

Timeline (Year)	Training Program/Classes	Purpose of Training	Name of Provider	Number of Trainees	Trainee Positions	Training Hours	Training Frequency	Estimated costs per Class
2019/2020	BEB Driver	Familiarize operators with BEB technology including high voltage safety and regenerative braking techniques	Initial training was from New Flyer	666	Bus Operators, Managers, Supervisors, & Training staff	133	Training was conducted daily (20 minutes per employee)	
2019/2020	Maintenance	Major component overview, PMIs, high voltage safety, and charging overview	Initial training was from 82New Flyer, Siemens (motor), & Xalt (battery	82	Trainers, Foreman & Service workers, Emergency Responders	64.75	Initial training was one time familiarization/ safety over a 5 month period. This included First Responders	

Section H: Potential Funding Sources

1. Please identify all potential funding sources your transit agency expects to use to acquire zero-emission technologies (both vehicles and infrastructure) (13 CCR § 2023.1(d)(1)(H)). (required)
 - Low Carbon Transit Operations Program (LCTOP) – Battery electric buses/Infrastructure

- *Transit Development Act (TDA) – Infrastructure*
- *Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP) – 6 Battery electric buses & 6 electric chargers*
- *Transit Intercity Rail Capital Program (TIRCP) – 12 Artic 60’ battery electric buses & 6 chargers/dispensers & overhead gantry systems*
- *Low or No Emission Grant*

2. In Table 9, please describe how the identified potential funding sources could support your transit agency to execute the Rollout Plan as currently designed by describing how each fund is planned to be used over time (e.g. to purchase a zero-emission bus, maintain a zero-emission bus, upgrade the charging/fueling infrastructure, construct or upgrade a maintenance facility). Please also identify how many zero-emission buses and/or which type(s) of infrastructure might be purchased, installed, or maintained with each funding source. (optional)

Table 9: Potential Funding Sources (optional)

Timeline (Year)	Name of Funding Source	How Each Fund is Planned to be Used	Estimated Amount(s) of Each Funding Source (\$)	Number of ZEBs to Purchase or Type(s) of Infrastructure to Install or Upgrade
2019	<i>VW Mitigation Fund</i>	<i>Battery electric buses & infrastructure</i>	<i>\$2.3 million</i>	<i>13 40’ battery electric buses and depot charger equipment</i>
2020	<i>Low/No</i>	<i>Onsite energy generation</i>	<i>\$2.5 million</i>	<i>Two 1 MW RNG gensets and equipment to energize 6 - 150 kW depot chargers</i>
2020	<i>CEC – MD/HD ZEV Infrastructure for Transit Fleets</i>	<i>For battery electric bus charging infrastructure & equipment</i>	<i>?</i>	<i>Depot charging equipment and infrastructure including gantry systems</i>
2022	<i>TIRCP</i>	<i>battery electric buses & charging infrastructure</i>	<i>\$22 million</i>	<i>12 60’ battery electric buses, and some funding for at least 6 depot chargers/12 dispensers, and an overhead gantry system</i>

2022	HVIP	Battery electric buses	\$2.1 million	12 60' battery electric buses
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Section I: Start-up and Scale-up Challenges

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

- a. *Bus & charger communication protocol. Issues with charger and bus “handshake” causing either bus and/or charger to produce a fault error. In addition, with two chargers paired together to provide an option for higher rate of charge, there have been issues with a couple of the paired settings provided with the conjoined units.*
- b. *With a range limitation on battery electric buses, we have had to select certain schedules that are 150 miles or less identifying the battery electric buses as a sub-fleet, whereas CNG doesn’t have any concern with range and can run any schedule.*
- c. *Integrating bus & telematics systems into MTS’s existing regional management system.*

How might CARB assist you to overcome these challenges? Please share your recommendations. (optional)

- i. *A) If there was a standardization with communication between bus & chargers this may help mitigate some of the communication issues between bus’s battery management system (charger controller), and chargers current output.*
- ii. *B) Not sure how this can be influenced by CARB, but more of an OEM technological advancement process. Maybe if axle weight limits were lessened bus OEMs could potentially add more energy storage on electric buses.*
- iii. *C) CARB may be able to help influence California State bus procurement contracts to include a telematics open integration language to allow agencies for more cohesive integration process with existing systems in their network.*

2. Please describe any challenges your transit agency may face in scaling up zero-emission bus deployment. (optional)

- i. *Find funding to mitigate as much of the incremental cost associated with transitioning to a battery electric fleet.*
- ii. *Installing battery electric infrastructure designed for a site constrained bus maintenance yard.*
- iii. *Transitioning period with CNG fuel and installation of electric chargers*

- iv. *Charging schedule, especially near full ZEB deployment may be a challenge at getting all buses charged to meet pull out schedule. And, to try avoid charging during on-peak pricing times.*
- v. *Smart charging and how it will work with large battery electric fleets, and managing time-of-use charge sessions.*
- vi. *Utility providing the necessary power demand for full deployment battery electric bus scenario.*
- vii. *Redundant power for electric chargers.*
- viii. *Battery electric bus training and high voltage safety training.*
- ix. *Extended range electric buses not meeting the top 25% of MTS block schedules.*

b. How might CARB assist you to overcome these challenges? Please share your recommendations. (optional)

- i. *The most integral need for assistance will be with providing funding to assist agencies with covering as much or all incremental cost when transitioning to zero emission technology. And, potentially some operating cost if more manpower is required.*
 - ii. *More infrastructure funding to assist agencies with adding additional equipment/structures to help mitigate site constrained sites (examples: adding overhead gantry systems, parking structures, or a new facility).*
 - iii. *Funding assistance could assist with mitigation measure(s) with this.*
 - iv. *CARB could work/influence the CPUC to provide the local utilities the tools to provide transit specific rate cases (example: eliminating demand charges)*
 - v. *Same as above – to assist influence CPUC to provide transit specific rates and potentially to work with charger manufacturers in developing a cohesive charging management systems.*
 - vi. *CARB to continue to work with the CPUC in developing Transit Electrification programs that could assist with funding and specifications on project build outs within these programs*
 - vii. *Working with CPUC to include power redundancy/resiliency for programs for Transit Electrification.*
 - viii. *To assist with State Standard for training in battery electric and fuel cell bus technology, especially in high voltage safety.*
 - ix. *Promote and influence zero-emission bus technology advancement for range. Potentially, influencing to loosen axle weight restriction for zero emission buses. Range limitation with battery technology buses can have leniency clause that allows agencies to accommodate top 25% of long-ranged routes that BEBs can't meet be supplemented by conventional buses*
- c. *Some additional items CARB may be able to assist with:*
- i. *Assist with minimizing hydrogen fuel costs (kg), and electricity rates, and how to manage these systems such as charging management systems.*

- ii. The need for zero-emission standardization protocols such as charging interoperability including inductive systems, and electric charging redundant systems.*
- iii. Influence bus and charging manufacturers to standardize communication protocols between bus management systems and charging systems.*