

ZERO-EMISSION BUS ROLLOUT PLAN

Innovative Clean Transit Regulation

- Adopted in December 2018
- Zero-emission buses have no tailpipe emissions
- Minimum ZEB purchase requirement:
 - *25 percent requirement starting in 2023 for 40-foot buses*
 - *50 percent requirement starting in 2026 for 40-foot, 60-foot and “cutaway” buses (paratransit buses)*
 - *100 percent requirement starting in 2029*
- Submit ZEB Rollout Plan to CARB by July 1, 2020
- Credits for zero-emission mobility option
- Delay in ZEB purchase requirement if a certain number of ZEBs are purchased statewide by the end of 2020 and 2021

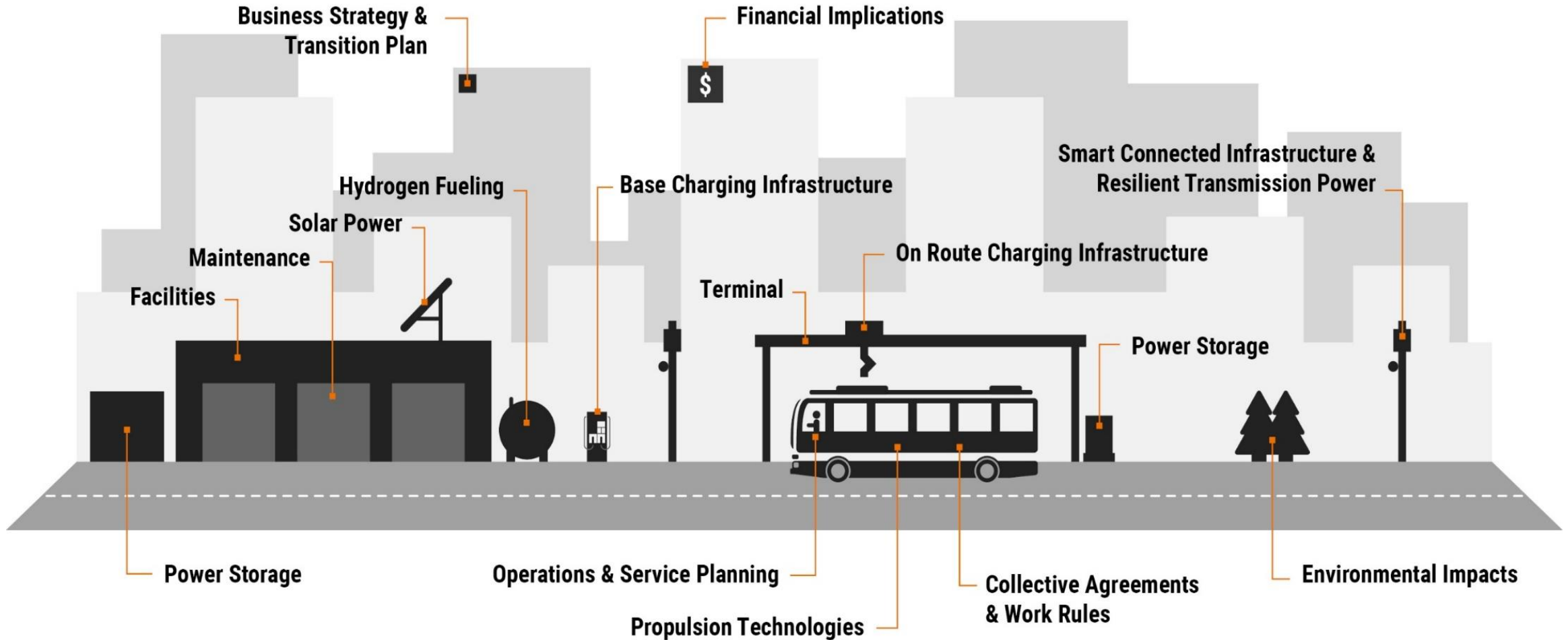
ZEB – Zero-emission bus

CARB – California Air Resources Board





What is Included in a ZEB Rollout Plan?

- 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
- Training plan for operators and maintenance staff
- Plan to deploy ZEBs in disadvantaged communities
- Goal of full transition to ZEBs by 2040
- A blueprint that can be amended as needed

Elements of ZEB Deployment



Existing OCTA Fleet

	Bus Type	Fuel Type	Fleet Size	Year Subject to ICT
	40-foot fixed-route	CNG	462	2023
	40-foot fixed-route	Hydrogen (FCEB)	10	Early ZEB purchase
	60-foot fixed-route	CNG	36	2026
	23-foot paratransit	Gasoline	248	2026

CNG – Compressed Natural Gas

FCEB – Fuel-Cell Electric Bus

ICT – Innovative Clean Transit

OCTA – Orange County Transportation Authority

Vehicle Fueling Technology Key Comparisons

Bus Type	CNG	Hydrogen Fuel-Cell Electric	Battery Electric
Vehicle Range	Longest	Middle	Shortest
Vehicle Cost	\$645,000	\$1,000,000 to \$1,300,000	\$1,000,000 to \$1,100,000
Fuel Cost	Lowest	Highest	Middle
Maintenance Cost	Highest	Middle	Lowest
Infrastructure Required	Existing fueling stations	New hydrogen fueling stations and facility upgrades	Extensive charging infrastructure and utility upgrades

OCTA Route Modeling Results

- Almost all current OCTA routes can be operated using hydrogen fuel-cell electric buses because of distances the buses need to cover
- A full battery-electric fleet would require additional buses and/or on-route charging to meet current OCTA service needs
- Future changes in vehicle technology and cost factors would inform future OCTA decisions regarding implementation of a zero-emission bus fleet

ZEB Deployment Strategy by Base

Bus Type	Garden Grove (Fixed-Route)	Santa Ana (Fixed-Route)	Anaheim (Fixed-Route)	Irvine (Fixed-Route)	Irvine (Paratransit)
Hydrogen Fuel-Cell Electric Buses	115	167	113	103	-
Battery-Electric Buses with Depot Charging	19	-	-	-	248
Total Buses	134	167	113	103	248

Fixed-Route Bus Purchases Outlook

<u>Fiscal Year</u>	<u>Buses to Purchase</u>	<u># of ZEB Purchases</u>	<u>% of Annual ZEB Purchases</u>	<u>Bus Type</u>	<u>ZEB Fuel Type(s)</u>	<u># of Conv. Bus Purchases</u>	<u>% of Annual Conv. Bus Purchases</u>	<u>Fuel Type(s) of Conv. Buses</u>
2020	304	10	3%	40-ft	BEB	294	97%	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%	60-ft	FCEB	0	0%	-
2030	0	0	-	-	-	0	-	-
2031	0	0	-	-	-	0	-	-
2032	157	157	100%	40-ft	FCEB/BEB	0	0%	-
	16	16	100%	60-ft	FCEB	0	0%	-
2033	0	0	-	-	-	0	-	-
2034	6	6	100%	40-ft	FCEB	0	0%	-
2035	10	10	100%	40-ft	FCEB	0	0%	-
2036	0	0	-	-	-	0	-	-
2037	0	0	-	-	-	0	-	-
2038	304	304	100%	40-ft	FCEB	0	0%	-
2039	0	0	-	-	-	0	-	-
2040	0	0	-	-	-	0	-	-

Conv. – Conventional
BEB – Battery-electric bus

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

ACCESS Paratransit Bus Purchases Outlook

<u>Timeline (Year)</u>	<u>Total # of Buses to Purchase</u>	<u># of ZEB Purchases</u>	<u>% of Annual ZEB Purchases</u>	<u>Bus Type</u>	<u>ZEB Fuel Type(s)</u>	<u># of Conv. Bus Purchases</u>	<u>% of Annual Conv. Bus Purchases</u>	<u>Fuel Type(s) of Conv. Buses</u>
2020	116	0	0%	Cutaway	-	116	100%	Unleaded
2021	3	0	0%	Cutaway	-	3	100%	Unleaded
2022	133	0	0%	Cutaway	-	133	100%	Unleaded
2023	3	0	0%	Cutaway	-	3	100%	Unleaded
2024	2	0	0%	Cutaway	-	2	100%	Unleaded
2025	5	0	0%	Cutaway	-	5	100%	Unleaded
2026	5	3	60%	Cutaway	BEB	2	40%	Unleaded
2027	122	61	50%	Cutaway	BEB	61	50%	Unleaded
2028	5	3	60%	Cutaway	BEB	2	40%	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%	-
2032	7	7	100%	Cutaway	BEB	0	0%	-
2033	7	7	100%	Cutaway	BEB	0	0%	-
2034	125	125	100%	Cutaway	BEB	0	0%	-
2035	8	8	100%	Cutaway	BEB	0	0%	-
2036	139	139	100%	Cutaway	BEB	0	0%	-
2037	9	9	100%	Cutaway	BEB	0	0%	-
2038	8	8	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.

OCTA ZEB Pilots

- **FCEBs**

- Commissioned hydrogen fueling station at the Santa Ana Bus Base
- Ten buses now in service
- Funded with state grant
- Credits for reduced future purchase requirements

- **BEBs**

- Procuring ten battery-electric buses starting in 2020
- Conducting assessment of power and charging equipment requirements at the Garden Grove Bus Base
- Working with electric utility to assess electric charger locations and necessary upgrades
- Pursuing grant funding for vehicles and infrastructure



40-foot Hydrogen Fuel-Cell Electric Bus



Hydrogen Fueling Station

Next Steps

- Submit Rollout Plan to CARB by July 1, 2020
- Continue procurements of CNG and unleaded buses until 2022
- Test hydrogen fuel-cell electric and battery-electric technology in revenue service
- Return to Transit Committee and Board of Directors meetings for periodic updates as needed
- Update the Rollout Plan as needed

CNG – Compressed natural gas

