



ZEROING IN ON ZERO-EMISSION BUSES

**THE ADVANCED TECHNOLOGY TRANSIT BUS INDEX:
A ZEB INVENTORY REPORT FOR THE UNITED STATES AND CANADA**

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Acronyms

BEB	Battery-electric bus
CARB	California Air Resources Board
CIB	Canadian Infrastructure Bank
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CUTRIC	Canadian Urban Transit Research & Innovation Consortium
EVID	Electric Vehicle Infrastructure Demonstration Program
FCEB	Fuel cell electric bus
FTA	Federal Transit Administration
Global MOU	Global Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles
H2Hubs	Regional Clean Hydrogen Hubs
HVIP	California's Clean Truck and Bus Voucher Incentive Project
ICT	Innovative Clean Transit (regulation)
IJA	Infrastructure Investment and Jobs Act
Low No	Low or No Emission Bus Program
MHDV	Medium- and heavy-duty vehicle
NYSERDA	New York State Energy Research and Development Authority
NYTVIP	New York Truck Voucher Incentive Program
ZEB	Zero-emission bus
ZETF	Zero Emission Transit Fund

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Executive Summary

Over the past year, transit agencies across the United States and Canada made steady, measurable strides in transitioning their fleets to zero-emission buses (ZEBs), providing cleaner air for communities across both countries. The number of full-size transit ZEBs in the United States has grown to 6,147 as of September 2023—an increase of 12 percent from the previous count—and includes more than 100 new fleets.¹ Canada also saw growth of approximately 12 percent and now has a total of 976 ZEBs. While the pace of adoption

The number of full-size ZEBs in the United States has grown to 6,147—an increase of 12 percent from 2022.

slowed for battery-electric buses (BEBs) compared to 2022, the number of fuel cell electric buses (FCEBs) increased by more than 75 percent, signifying a growing interest in fuel cell technology.

California continues its lead as the U.S. state with the most ZEBs adopted at 1,946. Meanwhile, many states saw notable gains in the number of ZEBs counted over the past year. New York state increased its number of ZEBs by 253 vehicles, a growth of 66 percent from 2022. Illinois, Massachusetts, Missouri, North Carolina, Ohio, and Oregon all increased the number of ZEBs in their respective states by more than 50 percent.

BEBs remain the dominant bus type, but FCEBs continue to see strong growth in the United States with a total of 372 full-size transit buses, representing an increase of 76 percent from 2022. The number of small ZEBs added to transit fleets grew by 15 percent. In addition, growth occurred in small private, airport, and university fleets nationwide; public fleets increased by 27 percent, while university fleets increased by 40 percent.

In 2023, almost \$1.7 billion was awarded through the Federal Transit Administration's (FTA) Low and No Emission (Low No) Program and the Grants for Buses and Bus Facilities Program. Funding was awarded to transit agencies in 46 states and territories and includes funding for approximately 1,700 transit buses (FTA, 2023). In total, 690 ZEBs were funded in 2023, representing 40 percent of all buses awarded. However, portions of this funding did support low-emission and conventional fuel buses, and the number of ZEBs funded in 2023 through the Low No and Buses and Bus Facilities grant programs accounts for 410 fewer buses when compared to 2022. It should be noted, however, that while the number of ZEBs funded was down compared to 2022, millions of dollars were awarded to transit agencies to support needed

The number of FCEBs increased by more than 75 percent, signifying a growing interest in fuel cell technology.

¹ ZEBs in this report are defined as Class 3 and above battery-electric or fuel cell electric transit buses that have been funded, ordered, delivered, and/or deployed within the United States and Canada, according to data collected through September 2023.

infrastructure for zero-emission projects. Infrastructure projects were awarded \$132 million in Low No funds and \$211 million in Buses and Bus Facilities funds (FTA, 2023a).

The Canadian government continues to support the adoption of zero-emission transit buses through the Zero Emission Transit Fund (ZETF). Started in August 2021, ZETF, which was allocated \$2.75 billion CAD to support adoption of ZEBs over five years, has supported the purchase of 2,500 ZEBs and 500 charging stations (Government of Canada, 2023). These historic levels of funding will be vital to support zero-emission transit projects, though there remains a significant unmet financial need between requests for funds and what is awarded.



I. Introduction

Since 2018, CALSTART has quantified the steady increase of zero-emission bus (ZEB) adoptions across the United States and Canada through its *Zeroing in on ZEBs* report series. It has proven to be the definitive resource for those seeking annual, up-to-date counts of ZEBs in both countries, offering context to the progress made toward adopting this critical technology.

Methodology

This report quantifies the adoption of ZEBs by technology: battery-electric buses (BEBs) and fuel cell electric buses (FCEBs). The data for this report is current as of September 2023 and was gathered primarily through local, state, and federal award documents; press releases; and author correspondence with 26 state Departments of Transportation and 85 transit agencies via email and phone interviews. Some adoption numbers may differ slightly from previous reports due to corrections in data provided by fleets.

This year's edition reintroduces the number of deployed buses within the total count. The authors have revised the data collection process to better refine the adoption categories as shown below and have included deployed vehicles, which were omitted from last year's report. These updated figures, however, should not be considered static. This report defines the **adoption** of transit ZEBs as those that have been funded, ordered, delivered, or deployed:

- **Funded:** Funding to support the procurement of the ZEB has been officially awarded.
- **Ordered:** The transit provider has submitted an order for the ZEB.
- **Delivered:** The ZEB has been received by the transit provider and is being prepared to be placed into operational service.
- **Deployed:** The ZEB has been placed in active operation by the transit provider.

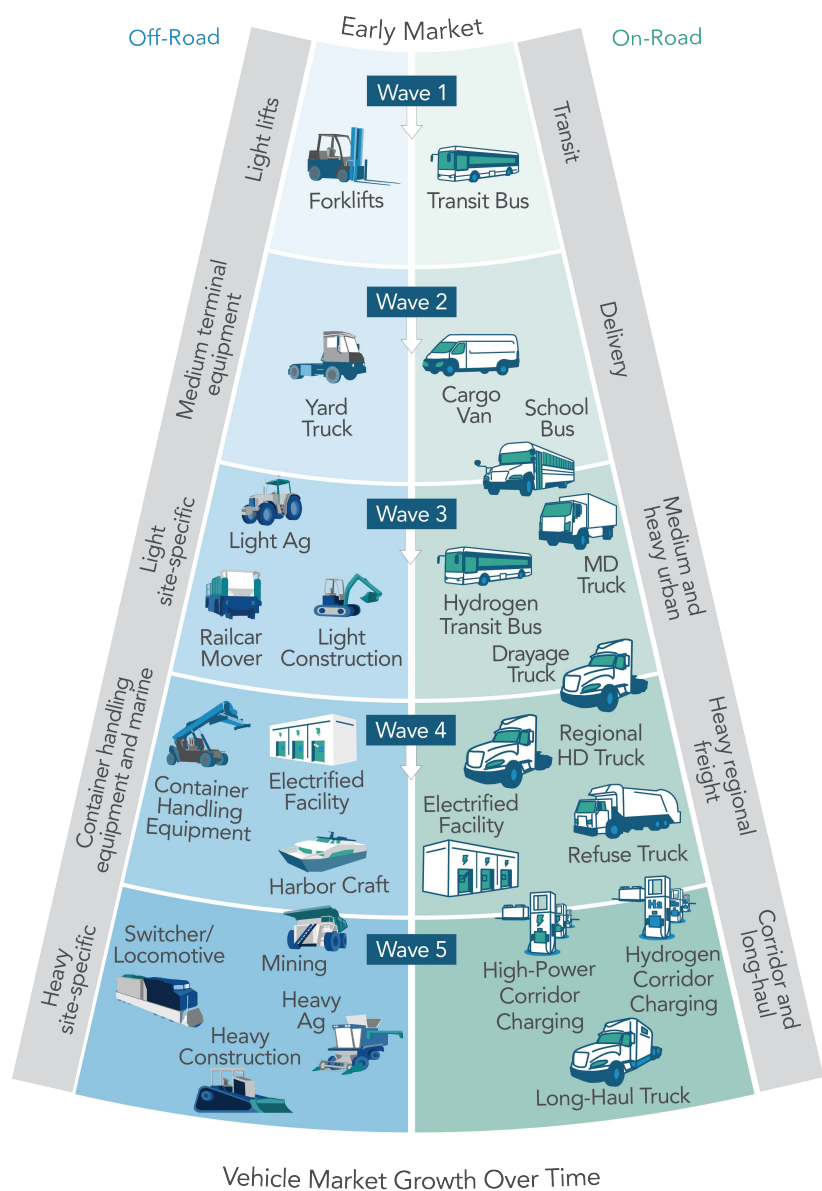
Background

Since the creation of the Clean Air Act, the U.S. government has worked with public and private organizations to reduce the amount of pollution from transit buses, which have historically operated on diesel fuel and release toxic fumes such as nitrogen oxides directly into communities. In 2022, the Federal Transit Administration's (FTA) Low and No Emission (Low No) Program was allocated a significant boost in funding with the passage of the Infrastructure Investment and Jobs Act (IIJA) of \$5.5 billion, which represented levels of funding six times greater than the funding provided in the previous five years of the program. In 2023, FTA awarded more than \$1.2 billion via Low No (FTA, 2023b). State-level grant programs, such as California's Clean Truck and Bus Voucher Incentive Project (HVIP) and the Transit and Intercity Rail Capital Program, as well as New York's Truck Voucher Incentive Program (NYTVIP), have also supported the

adoption of ZEBs for transit. Additionally, money from the 2016 Volkswagen Clean Air Act Civil Settlement was made available to states to purchase zero-emission vehicles.

ZEB adoption has continued to grow as organizations take advantage of the expanding number of vehicle models available and the advancements in battery-electric and fuel cell electric technologies. As a broader view, **Figure 1** is the most recent update of the zero-emission beachhead strategy, which was developed by CALSTART in partnership with the California Air Resources Board (CARB) to trace zero-emission technology adoption progress across different types of commercial vehicles, including buses. ZEBs are a foundational commercial vehicle market segment where zero-emission and near-zero-emission technologies are most likely to succeed first and can also contribute to the development of vehicles in other segments.

Figure 1. The Zero-Emission Beachhead (CARB, 2023)



II. U.S. Full-Size ZEB Count

Full-size ZEBs—defined as Class 7 or 8 transit buses that are 30 or more feet in length—have grown to a total of 6,147 funded, ordered, delivered, or deployed across the country, an increase of 12 percent since the 2022 count (**Table 1**). California continues to outpace the nation in the adoption of ZEBs with a count of 1,946 and accounts for 32 percent of all ZEBs nationwide. New York state (742), Florida (464), and Washington state (214) round out the top four states with the most ZEBs adopted. New York state had the largest increase in the number of ZEBs from last year, adding more than 250 ZEBs to its transit fleets.

Table 1. U.S. Full-Size Transit ZEBs’ Year-Over-Year Growth

Bus Type	2022	2023	Increase (2022 to 2023)	Growth %
BEB	5,269	5,775	506	10%
FCEB	211	327	161	76%
Total ZEBs	5,480	6,147	667	12%

While BEBs remain the dominant ZEB type, FCEBs continued to see strong growth in 2023, increasing by 76 percent overall. In total, 13 states reported FCEBs among their transit fleets (**Table 2**). California continues to lead the country in the number of FCEBs adopted with 140 vehicles in total. That figure is expected to grow exponentially in the coming years, as California agencies have reported plans to adopt more than 2,000 FCEBs (CARB, 2022). Another notable FCEB project is the Regional Transportation Commission of Southern Nevada introducing two FCEBs this year as part of a multiyear deployment strategy with additional vehicles, including 60-foot articulated FCEBs, expected in 2024 (Las Vegas Review-Journal, 2023).

Table 2. U.S. Full-Size Transit FCEBs' Year-Over-Year Growth

State	2022	2023	Difference ²
Alabama	1	1	0
Arizona	12	12	0
California	136	276	140
Delaware	2	16	14
Hawaii	7	7	0
Illinois	2	12	10
Maryland	13	13	0
Massachusetts	3	1	-2
Michigan	4	4	0
Nevada	6	10	4
New York	5	5	0
Ohio	13	13	0
Texas	5	0	-5
Washington	2	2	0
Total	211	372	161

It is anticipated that interest in FCEBs will continue to grow, particularly as transit fleets move away from pilot projects and toward full-scale replacement of their internal combustion engine fleets. Based on a transit agency's specific needs, FCEBs may be a better option than BEBs thanks to increased range and fueling time like that of a conventional diesel bus. Additionally, with the announcement from the Biden administration that seven Regional Clean Hydrogen Hubs (H2Hubs) have been selected, one of the potential barriers to the adoption of FCEBs—where to source hydrogen fuel needed for fleets—may soon be addressed. The H2Hubs are expected to produce 3 million metric tons of hydrogen on an annual basis (U.S. Department of Energy, 2023).

² Any negative differences in Table 2 are due to corrections in data provided by fleets.

Figure 2 provides a breakdown of the number of full-size ZEBs adopted per state. **Table 3** further disaggregates this data and provides a state-by-state breakdown of the number of BEBs and FCEBs adopted. California maintains its lead as the state with the most ZEBs in the nation, with more than double the number of ZEBs than New York, the next closest state. Florida, Washington, and Texas round out the top five.

Figure 2. Full-Size Transit ZEBs Funded, Ordered, Delivered, or Deployed Within the United States (As of September 2023)

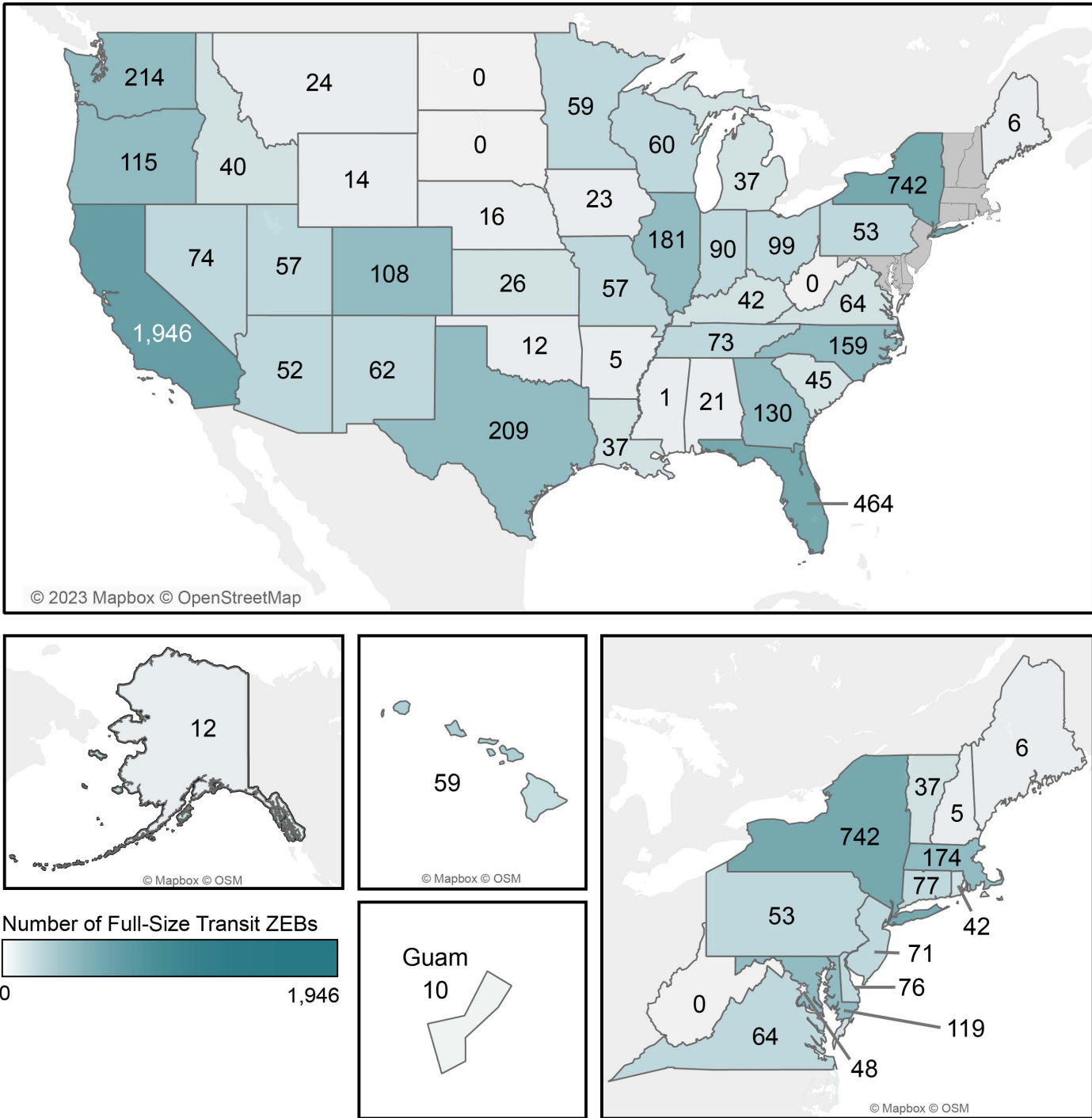


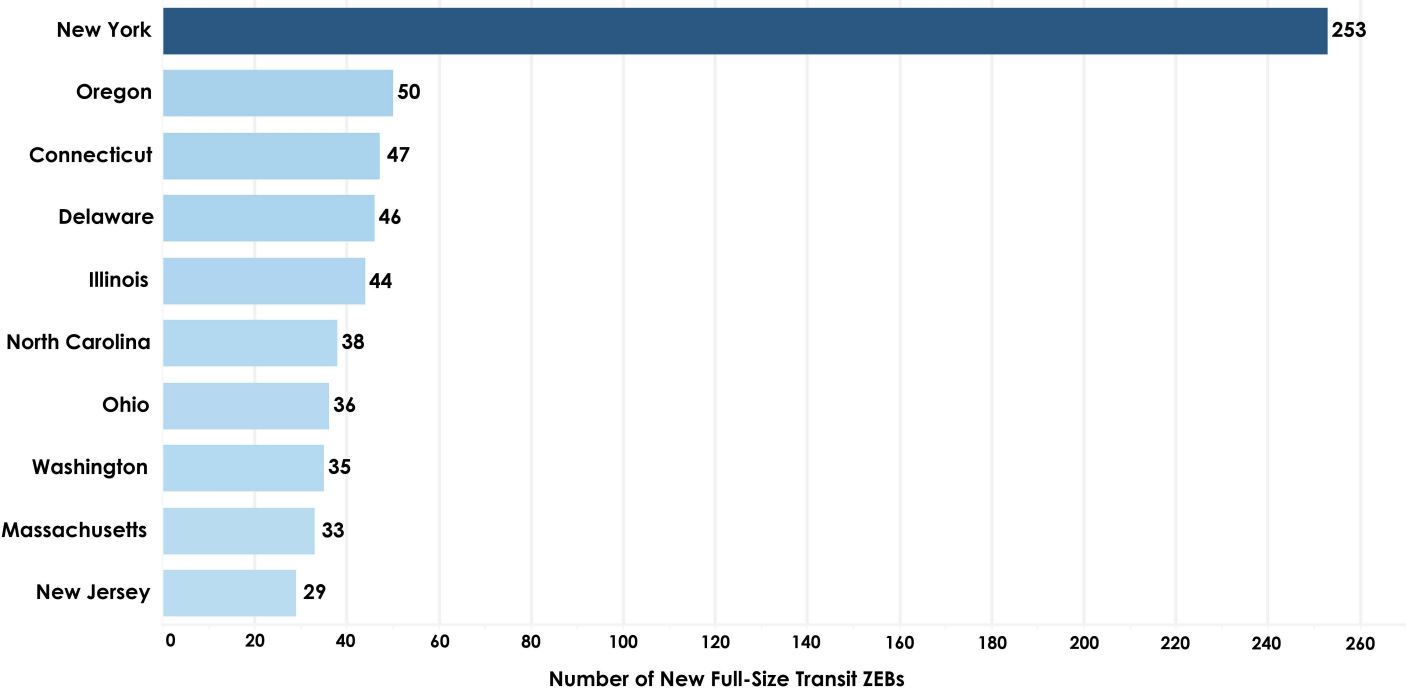
Table 3. State-By-State Full-Size Transit ZEB Distribution (As of September 2023)

State	FTA Region		BEBs	FCEBs	Total ZEBs
Alabama	AL	4	20	1	21
Alaska	AK	10	12	0	12
Arizona	AZ	9	40	12	52
Arkansas	AR	6	5	0	5
California	CA	9	1,670	276	1,946
Colorado	CO	8	108	0	108
Connecticut	CT	1	77	0	77
Delaware	DE	3	60	16	76
District of Columbia	DC	3	48	0	48
Florida	FL	4	464	0	464
Georgia	GA	4	130	0	130
Hawaii	HI	9	52	7	59
Idaho	ID	10	40	0	40
Illinois	IL	5	169	12	181
Indiana	IN	5	90	0	90
Iowa	IA	7	23	0	23
Kansas	KS	7	26	0	26
Kentucky	KY	4	42	0	42
Louisiana	LA	6	37	0	37
Maine	ME	1	6	0	6
Maryland	MD	3	106	13	119
Massachusetts	MA	1	173	1	174
Michigan	MI	5	33	4	37
Minnesota	MN	5	59	0	59
Mississippi	MS	4	1	0	1
Missouri	MO	7	57	0	57
Montana	MT	8	24	0	24
Nebraska	NE	7	16	0	16

State		FTA Region	BEBs	FCEBs	Total ZEBs
Nevada	NV	9	64	10	74
New Hampshire	NH	1	5	0	5
New Jersey	NJ	2	71	0	71
New Mexico	NM	6	62	0	62
New York	NY	2	737	5	742
North Carolina	NC	4	159	0	159
North Dakota	ND	8	0	0	0
Ohio	OH	5	86	13	99
Oklahoma	OK	6	12	0	12
Oregon	OR	10	115	0	115
Pennsylvania	PA	3	53	0	53
Rhode Island	RI	1	42	0	42
South Carolina	SC	4	45	0	45
South Dakota	SD	8	0	0	0
Tennessee	TN	4	73	0	73
Texas	TX	6	209	0	209
Utah	UT	8	57	0	57
Vermont	VT	1	37	0	37
Virginia	VA	3	64	0	64
Washington	WA	10	212	2	214
West Virginia	WV	3	0	0	0
Wisconsin	WI	5	60	0	60
Wyoming	WY	8	14	0	14
Guam	GU	9	10	0	10
Total	-	-	5,775	372	6,147

Growth occurred in every FTA region but two in the past year. Region 2—New Jersey and New York—grew 53 percent compared to 2022. In total, Region 2 received \$76 million to support 20 ZEBs, associated infrastructure, and workforce development initiatives. Region 10—Alaska, Idaho, Oregon, and Wisconsin—was second highest with a growth rate of 33 percent. Region 10 was awarded \$59 million to support zero-emission projects including 41 ZEBs, of which 30 were included in a successful award to King County Metro Transit totaling more than \$33 million. Region 1, which grew by 32 percent, received nearly \$60 million for 44 ZEBs and associated infrastructure. The region with the lowest growth rate was Region 8, which showed a decrease of 15 percent. For detailed information on growth per FTA region, refer to Appendix A. **Figure 3** highlights the 10 states with the largest numerical increases in full-size ZEB adoption since the previous count.

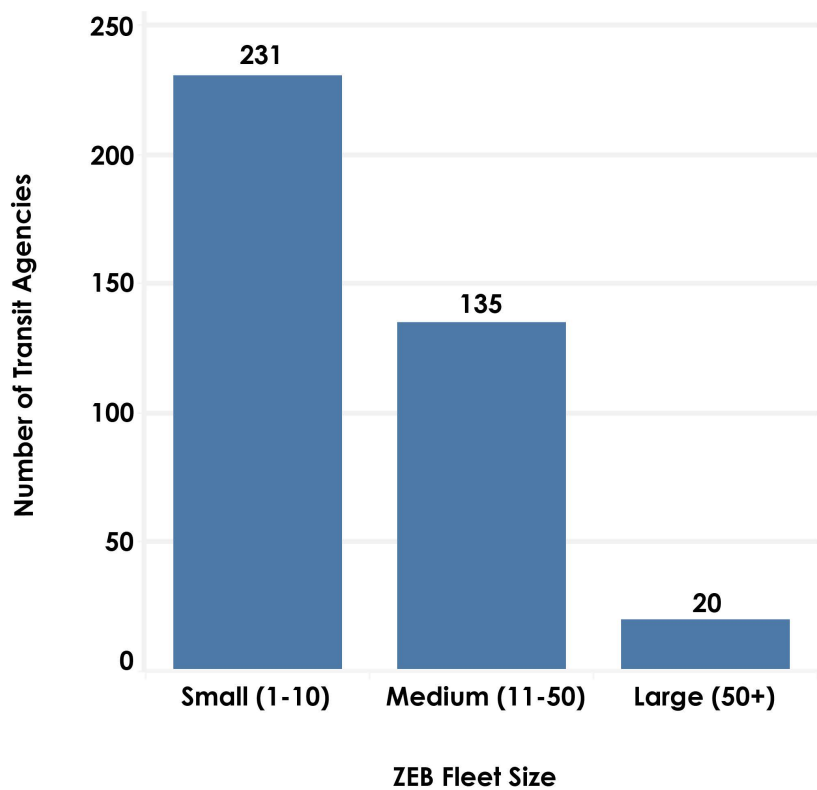
Figure 3. Top 10 States with Largest Numerical Increases in Full-Size Transit ZEB Adoption (Compared to 2022)



The median number of full-size ZEBs per transit agency nationwide increased from five in 2022 to eight in 2023. New York’s Metropolitan Transportation Authority has the largest full-size ZEB fleet with 545 buses as of September 2023. The Los Angeles Department of Transportation, Los Angeles Metro, Miami-Dade County, and Santa Monica’s Big Blue Bus round out the top five largest fleets in the nation with ZEBs.

Approximately 60 percent of transit fleets in the United States have 10 or fewer ZEBs. Overall, that percentage has remained relatively unchanged since 2022 (**Figure 4**).

Figure 4. Distribution of Full-Size Transit ZEB Fleet Size in the United States



While 60 percent is an improvement from the previous year, much work remains to get fleets to adopt ZEBs at scale. Across the nation, transit agencies continue to grapple with several challenges in adopting ZEBs into their fleets, and these challenges certainly play a role in the pace of adoption. Challenges include a dwindling zero-emission vehicle manufacturer pool, high upfront costs, lack of needed funding, lack of needed infrastructure, and lack of assurance that the workforce is adequately trained and prepared to maintain and operate ZEBs. FTA and other federal agencies, as well as states, continue to take steps to address these challenges and give transit agencies the tools and resources they need to successfully adopt and deploy ZEBs. These policies and resources are discussed in detail in Section IV of this report.

III. U.S. Small ZEB Count

Small ZEBs—defined as transit buses that are Class 3–6 and shorter than 30 feet—account for a significant number of vehicles in use by transit fleets today. According to FTA’s National Transit Database 2022 Vehicle Data Table, small buses total more than 57,000 vehicles compared to 59,000 transit buses (FTA, 2022). Transit agencies continue to look for ways to transition their small bus fleets to ZEBs.

Small buses remain the mainstay for providing demand-response service for senior citizens and individuals with disabilities, but as transit agencies continue to seek cost-effective and innovative ways to boost ridership, small buses are being utilized for services such as microtransit. A recent American Public Transportation Association report showcased nearly two dozen microtransit projects across the nation to include projects for Los Angeles Metro; King County Metro in Seattle, Washington; and Flint Mass Transit in Flint, Michigan (American Public Transportation Association, 2022). The continued demand for small buses, coupled with new and innovative service models, will provide opportunities for transit agencies to not only offer cost-effective options to help boost ridership but also to transition their small bus fleets to ZEBs.

As of September 2023, 1,010 small ZEBs have been adopted in the United States. This figure, which includes small ZEBs adopted by public transit agencies, private fleets, and airports, grew by 134 from 2022; this represents an overall increase of 15 percent year-over-year, though that rate is noticeably lower than the previous year. While the pace of adoption slowed, there are now nearly 200 fleets that have at least one small ZEB, nearly double the number reported in 2022. The number of small ZEBs grew for every fleet type as shown in **Table 4**, including growth of 27 percent in public fleets and 40 percent in university fleets. Based on the data collected, no new small FCEBs were purchased over the last year. See **Table 4** for a breakdown of small ZEBs’ year-over-year growth.

Table 4. U.S. Small Transit ZEBs’ Year-Over-Year Growth

Fuel Type	Fleet Type	2022	2023	Difference (2022 to 2023)	Growth %
BEB	Public	417	529	112	27%
	Private	298	312	14	5%
	Airport	142	146	4	3%
	University	10	14	4	40%
FCEB	Public	9	9	0	0%
	Private	0	0	0	0%
	Airport	0	0	0	0%
	University	0	0	0	0%
Total	-	876	1,010	134	15%

Transit agencies in Alabama, Massachusetts, New Jersey, Pennsylvania, and Tennessee purchased their first small ZEBs in 2023 (**Table 5**). Illinois had the largest year-over-year increase in small ZEBs of 44, which is four times the state's count in 2022. The majority of small ZEBs remain battery-electric. The nine small FCEBs counted in California and Ohio did not change from 2022. All small FCEBs that have been adopted reside with public agencies.

Table 5. State-By-State Small Transit ZEB Distribution (As of September 2023)

State		FTA Region	BEBs	FCEBs	Total ZEBs
Alabama	AL	4	1	0	1
Arizona	AZ	9	11	0	11
California	CA	9	598	4	602
Colorado	CO	8	11	0	11
Connecticut	CT	1	0	0	0
Florida	FL	4	5	0	5
Georgia	GA	4	4	0	4
Hawaii	HI	9	5	0	5
Illinois	IL	5	54	0	54
Indiana	IN	5	2	0	2
Iowa	IA	7	33	0	33
Louisiana	LA	6	0	0	0
Kansas	KS	7	18	0	18
Maryland	MD	3	5	0	5
Massachusetts	MA	1	29	0	29
Michigan	MI	5	35	0	35
Minnesota	MN	7	19	0	19
Missouri	MO	7	19	0	19
Nevada	NV	9	0	0	0
New Jersey	NJ	2	4	0	4
New Mexico	NM	6	3	0	3
New York	NY	2	4	0	4
Ohio	OH	5	16	5	21
Oregon	OR	10	14	0	14
Pennsylvania	PA	3	1	0	1
Tennessee	TN	4	2	0	2
Texas	TX	6	66	0	66
Vermont	VT	1	19	0	19
Washington	WA	10	10	0	10
Wisconsin	WI	5	13	0	13
Total	-	-	1,001	9	1,010

IV. U.S. Airport ZEB Count

Growth in the number of ZEBs in service at U.S. airports continued in 2023. The Airport Zero Emission Vehicle and Infrastructure Pilot Program provided \$15 million to U.S. airports for ZEBs and supporting infrastructure in fiscal year 2023 (Federal Aviation Administration, 2023). This program, created in 2021, provides grants for airport-owned ZEBs. In 2023, the Federal Aviation Administration also announced \$92 million in funding for 21 airports to support ZEBs, charging infrastructure, and studies for electrification (Federal Aviation Administration, 2023a).

As of September 2023, the number of airport ZEBs in the United States has grown to 196 full-size ZEBs, all of which are battery-electric, and 146 small ZEBs (see **Table 6** for state-by-state distribution). Of this total, 49 new full-size and small ZEBs were adopted in 2023, representing an overall growth of 17 percent from 2022. It is important to note that the airport small ZEBs reported in this section were also included in the overall small ZEB count (refer to Section III).

Table 6. Airport ZEBs' State-By-State Distribution (As of September 2023)

State		Full-Size Buses	Small Buses	Total
California	CA	93	117	210
Florida	FL	4	0	4
Hawaii	HI	0	4	4
Indiana	IN	9	2	11
Michigan	MI	0	4	4
Missouri	MO	7	19	26
Nevada	NV	23	0	23
New Jersey	NJ	12	0	12
New York	NY	24	0	24
North Carolina	NC	24	0	24
Total	-	196	146	342

ZEBs in service at airports are typically used as “people movers” to transport airline passengers and employees from parking lots to the airport terminal and back. Many private companies that operate offsite parking lots have also adopted ZEBs to transport airline passengers to and from the airport. The majority of airport ZEB adoptions remain in California due in large part to its Zero-Emission Airport Shuttle Regulation, which mandates that bus operators in 13 of the state’s largest airports must fully transition to zero-emission shuttle buses by 2035 (CARB, 2019). California is certainly not the only state seeing the transition to ZEBs at its airports. Kansas City International Airport has embarked on a \$1.5 billion terminal project that includes wireless inductive charging to support its ZEB fleet (Airports International, 2023). Tampa International Airport is another example of a U.S. airport adopting ZEBs to achieve its sustainability goals. In 2023, Tampa International added four new buses to its fleet responsible for transporting employees around the airport (Tampa Airport, 2023).

V. Canadian ZEB Count

ZEB adoptions in Canada grew once again thanks to supportive funding and policy efforts. In 2020, \$1.5 billion CAD was made available to support the adoption of ZEBs and supporting infrastructure. That funding was followed by \$14.9 billion CAD for public transportation projects, and in August 2021, the Zero Emission Transit Fund (ZETF) was announced. ZETF also includes \$10 million CAD to support planning efforts toward fleet electrification (Government of Canada, 2021). Transit agencies in Montréal and British Columbia have committed to having completely zero-emission fleets by 2040. ZEBs are now located in eight of the 10 Canadian provinces, up from seven as noted in last year's report, stretching from British Columbia to Québec and Nova Scotia (**Table 7**).

Table 7. Transit ZEBs by Canadian Province (As of September 2023)

Province	BEBs	FCEBs	Total ZEBs
Alberta	81	0	81
British Columbia	31	0	31
Manitoba	66	28	94
New Brunswick	12	0	12
Newfoundland and Labrador	0	0	0
Nova Scotia	60	0	60
Ontario	584	10	594
Prince Edward Island	0	0	0
Québec	74	0	74
Saskatchewan	30	0	30
Total	938	38	976

As of September 2023, based on data submitted to the authors from primary and secondary sources, Canada has adopted 976 full-size and small ZEBs, including 79 new full-size ZEBs since 2022. Of the total ZEBs counted, 938 are BEBs and 38 are FCEBs. Data utilized by the authors included primary sources such as data received directly from transit agencies, as well as secondary sources such as press releases. For a deeper look at the Canadian ZEB landscape, refer to the Canadian Urban Transit Research & Innovation Consortium's (CUTRIC) ZEB Database™. CUTRIC's most recent update to their ZEB database was released on December 3, 2023, and includes analysis of ZEBs in the pronouncement stage as well as the feasibility stage; these two categories are not included in this report's data collection methodology.

The largest Canadian province of Ontario continues to lead the country in the adoption of ZEBs. The City of Burlington, Ontario, received \$370,000 CAD from ZETF to begin implementing ZEB goals, and Quinte West, Ontario, received \$100,000 CAD to support fleet transition planning efforts (Mass Transit, 2023). In a significant boost to their zero-emission efforts, BC Transit is receiving \$395.5 million CAD for the purchase of more than 100 BEBs and more than 130 charging ports to support their fleet (Electric Autonomy, 2023). Perhaps the biggest announcement for zero-emission efforts in Canada came when the government of Quebec announced plans to add 1,229 ZEBs to its fleet at a cost greater than \$1.8 billion CAD. The Canadian government announced it would contribute \$780 million CAD to what is the largest ZEB project in North America (National Observer, 2023).

VI. U.S. Policy and Funding Sources

The transportation sector remains the largest emitter of greenhouse gases in the United States, accounting for 28 percent of total greenhouse gas emissions (U.S. Environmental Protection Agency, 2023). In order to combat climate change and improve air quality, the U.S. government aims to transition to ZEBs. Both federal and state governments have introduced policies and funding sources to encourage this transition. These policies and funding sources are vital in accelerating the adoption of ZEBs across the country. Globally, more than 30 countries have signed the **Global Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles (Global MOU)**. This international agreement supports a path to 100 percent new zero-emission medium- and heavy-duty vehicle (MHDV) sales by 2040, with an interim goal of 30 percent new zero-emission MHDV sales by 2030.³

FTA's **Low No Program** continues to be the main source of federal funding for ZEBs in the United States. The Low No Program supports U.S. transit fleets as they continue their transition to the most energy-efficient and lowest polluting transit vehicles available. Low No saw a significant boost in funding—\$1.10 billion in 2022 compared to \$182 million in 2021—due to the passage of **IIJA**, which was signed into law by President Biden in November of 2021 (FTA, 2022). IIJA provides \$5.25 billion in funding over five years to FTA's Low No Program (FTA, 2022a). Low No is a competitive grant program that helps state and local government entities purchase or lease zero-emission and low-emission transit buses and pay for necessary supporting facilities and infrastructure as well as workforce training for maintenance staff and bus drivers. Coupled with Low No is FTA's Grants for **Buses and Bus Facilities Competitive Program**. The Buses and Bus Facilities grant program makes funding available to states, designated recipients, and local governments that operate fixed-route bus service to replace, rehabilitate, and purchase buses and related equipment and to construct needed facilities. The financial support provided through Low No and the Buses and Bus Facilities grant program is critical to support the continued adoption of ZEBs.

Demand for both Low No and Buses and Bus Facilities funds remained strong in 2023. Between the two programs, there were 475 eligible applications submitted, resulting in 130 awards to 46 states totaling nearly \$1.7 billion (FTA, 2023). In total, 690 ZEBs were funded in 2023, and those 690 buses represent 40 percent of all buses awarded. However, 36 percent of funding went to low-emission vehicles, while nearly one-quarter of funding supported conventional fuel buses. It should be noted that the number of ZEBs funded in 2023 through the Low and No Emission and Buses and Bus Facilities grant programs accounts for 410 fewer buses when compared to 2022. However, while the number of ZEBs funded was down compared to 2022, millions of dollars were awarded to transit agencies to support needed infrastructure for zero-emission projects. Infrastructure projects were awarded \$132 million in Low No funds and \$211 million in Buses and Bus Facilities funds (FTA, 2023a).

³ The Global MOU is co-led by the nation of the Netherlands and CALSTART's Global Commercial Vehicle Drive to Zero™ program and campaign; for [more information](https://globaldrivetozero.org/mou/), visit <https://globaldrivetozero.org/mou/>.

Additionally, while FTA awarded nearly \$1.7 billion for ZEBs, the total combined ask from transit agencies based on submitted applications was more than \$8 billion. As highlighted in last year's report, there remains a significant unmet financial need between requests for funds and what is awarded.

Other federal programs like the **Congestion Mitigation and Air Quality Improvement (CMAQ) Program** have also been used to fund ZEB purchases. IIJA provides \$13.2 billion in funding for CMAQ over five years, which will open additional funding sources for ZEB investments (Congressional Research Service, 2022). Likewise, the **Commercial Clean Vehicle Credit** provides tax credits of \$40,000 for vehicles, which includes transit buses, with a gross vehicle weight rating over 14,000 pounds (Internal Revenue Service, 2023). The tax credit is designed to help offset the incremental upfront cost that a transit agency may incur when purchasing ZEBs.

Beyond federal policy, states have also played a key role in supporting the adoption of ZEBs. California launched the HVIP program in 2009 and to date, nearly 1,000 vouchers for heavy- and medium-duty buses have been redeemed. The vouchers underwrite point-of-purchase price reductions to fleets for clean commercial vehicles like ZEBs. The 1,000 vouchers redeemed account for more than \$126 million in funding for ZEBs within the state of California (CARB, 2023a).

Planning and implementation for fully zero-emission transit continued in California, and 2023 marked an important milestone in the state's implementation of the **Innovative Clean Transit (ICT) regulation**, as all small transit agencies subject to ICT were required to submit their rollout plans by June 30, 2023. Enacted in 2018, the ICT regulation requires all public transit agencies to gradually transition their bus fleets to zero-emission technologies. The regulation applies to all transit agencies that own, operate, or lease buses with a gross vehicle weight rating greater than 14,000 pounds, which covers all standard, articulated, over-the-road, double-decker, and cutaway buses. The regulation requires a percentage of new bus purchases to be zero-emission beginning in 2023; by 2029, 100 percent of all new bus purchases in California must be zero-emission (CARB, 2019a). The goal of the ICT regulation is for all transit agency fleets to be zero-emission by 2040. Three transit agencies have already completed the transition to zero-emission fleets: Antelope Valley Transit Authority, City of Artesia, and the City of South Pasadena. Five California transit agencies are on track to reach zero-emission goals 10 years ahead of schedule: Los Angeles Department of Transportation, Los Angeles County Metropolitan Transportation Authority, Foothill Transit, Long Beach Transit, and Santa Monica's Big Blue Bus.

In New York state, the New York Voucher Incentive Program, **NYTVIP**, administered by the New York State Energy Research and Development Authority (NYSERDA), continues to provide vouchers to support transit agencies' adoption of ZEBs. There are currently five transit agencies that are eligible for NYTVIP funding: Capital District Transportation Authority, Niagara Frontier Transportation Authority, Rochester-Genesee Regional Transit Authority, Suffolk County Transit, and Westchester County Vee-Line Bus System (NYSERDA, 2023).

The **Multi-State Medium- and Heavy-Duty Zero Emission Vehicle Memorandum of Understanding (Multi-State MOU)** was signed in July 2020 by Washington, D.C. and 18 states (California, Colorado, Connecticut, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, Nevada, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington). In 2022, the signatories developed an

action plan in coordination with the Northeast States for Coordinated Air Use Management that included more than 65 recommendations to support the transition to clean transportation while doing so at scale and in an equitable fashion. In particular, the task force highlighted the benefits of regulation coupled with incentive programs like HVIP and NYTVIP to hasten the adoption of clean transportation vehicles like ZEBs (NESCAUM, 2022).

Beyond California and New York, states including Indiana, Massachusetts, Montana, Virginia, and Washington offer incentives, rebates, and grants to support the adoption of ZEBs and associated infrastructure (National Conference of State Legislators, 2023).

With policy and funding efforts at the federal and state level supporting transit agencies adopting ZEBs, tools such as statewide procurement contracts should continue to be utilized wherever practical. As CALSTART has previously reported, statewide contracts provide a means for transit agencies to reduce the cost and effort of procuring ZEBs while ensuring compliance with federal and state regulations (CALSTART, 2020). The usage of statewide contracts can quicken the process of purchasing ZEBs, which can get more of these vehicles in service faster. Outside of state-led procurement efforts, transit agencies themselves are also successfully pooling their resources to develop joint procurement efforts to reduce costs and utilize public dollars. In Florida, led by Pinellas Suncoast Transit Authority, a consortium of transit agencies in the state developed a bus procurement contract enabling agencies to procure ZEBs from multiple manufacturers (Pinellas Suncoast Transit Authority, 2021).

VII. Canadian Policy and Funding Sources

The policies and funding sources that the Canadian government has put in place over the past decade continue to have a strong impact on the rapid growth of ZEBs in the country. While no major new policy or funding announcements were made since the last report, the following play an important role in reducing greenhouse gas emissions and decarbonizing public transportation by encouraging the adoption of ZEBs:

- Started by Natural Resources Canada, the **Electric Vehicle Infrastructure Demonstration (EVID)** Program received \$76 million CAD in funding from the Canadian government under 2016 and 2017 budgets (Government of Canada, 2022). EVID supports demonstrations of next-generation and innovative electric vehicle charging and hydrogen refueling infrastructure. To date, EVID has funded more than 20 demonstration projects, including bus and infrastructure projects at the Toronto Transit Commission, Brampton Transit, and TransLink.
- Canada's **2020 Climate Change Plan** (titled *A Healthy Environment and a Healthy Economy: Canada's Strengthened Climate Plan to Create Jobs and Support People, Communities, and the Planet*) aims for the country to be net zero-emission by 2050. This plan includes the electrification of public transit and calls for 5,000 ZEBs (both transit and school buses) (Government of Canada, 2021a).⁴
- In 2022, Canada announced an incentive program to further spur the adoption of MHDVs. The **Incentives for Medium- and Heavy-Duty Zero-Emission Vehicles** provides \$547.5 million CAD over four years toward the purchase or lease of eligible MHDVs (Government of Canada, 2022a).
- The Canadian government provided financing mechanisms to support the 2020 Climate Change Plan's objective of deploying 5,000 ZEBs, most notably through **ZETF**. Funded at \$2.75 billion CAD, ZETF was created to support public transit and school bus operators transitioning to zero-emission fleets (Government of Canada, 2021). Funding from ZETF can also be used for infrastructure and site upgrades.
- The **Canadian Infrastructure Bank (CIB)**, a federal Crown Corporation of Canada that works with government and private investors to attract private capital to infrastructure projects, has a \$1.5 billion CAD initiative (in addition to the \$14.9 billion CAD from Infrastructure Canada) to deploy 4,000 ZEBs (both transit and school buses) over three years (CIB, 2021).

⁴ It should be noted that the Canadian government has not been transparent regarding if buses using renewable natural gas count as ZEBs under their definition.

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Appendix A: Breakdown of ZEB Distribution by FTA Region

The following tables list the count of full-size transit ZEBs for each FTA region by state as of September 2023.

Table A-1. FTA Region 1 State-By-State Full-Size Transit ZEB Distribution

Total Buses = 341 (32% Growth from 2022)

State		BEBs	FCEBs	Total ZEBs
Connecticut	CT	77	0	77
Maine	ME	6	0	6
Massachusetts	MA	173	1	174
New Hampshire	NH	5	0	5
Rhode Island	RI	42	0	42
Vermont	VT	37	0	37
Total		340	1	341

Table A-2. FTA Region 2 State-By-State Full-Size Transit ZEB Distribution

Total Buses = 813 (53% Growth from 2022)

State		BEBs	FCEBs	Total ZEBs
New Jersey	NJ	71	0	71
New York	NY	737	5	742
Total		808	5	813

Table A-3. FTA Region 3 State-By-State Full-Size Transit ZEB Distribution

Total Buses = 360 (26% Growth from 2022)

State		BEBs	FCEBs	Total ZEBs
Delaware	DE	60	16	76
District of Columbia	DC	48	0	48
Maryland	MD	106	13	119
Pennsylvania	PA	53	0	53
Virginia	VA	64	0	64
West Virginia	WV	0	0	0
Total		331	29	360

Table A-4. FTA Region 4 State-By-State Full-Size Transit ZEB Distribution**Total Buses = 939 (9% Growth from 2022)**

State		BEBs	FCEBs	Total ZEBs
Alabama	AL	20	1	21
Florida	FL	464	0	464
Georgia	GA	130	0	130
Kentucky	KY	42	0	42
Mississippi	MS	1	0	1
North Carolina	NC	159	0	159
South Carolina	SC	45	0	45
Tennessee	TN	73	0	73
Total		938	1	939

Table A-5. FTA Region 5 State-By-State Full-Size Transit ZEB Distribution**Total Buses = 531 (26% Growth from 2022)**

State		BEBs	FCEBs	Total ZEBs
Illinois	IL	169	12	181
Indiana	IN	90	0	90
Michigan	MI	33	4	37
Minnesota	MN	59	0	59
Ohio	OH	86	13	99
Wisconsin	WI	60	0	60
Total		497	34	531

Table A-6. FTA Region 6 State-By-State Full-Size Transit ZEB Distribution**Total Buses = 325 (12% Decrease from 2022)**

State		BEBs	FCEBs	Total ZEBs
Arkansas	AR	5	0	5
Louisiana	LA	37	0	37
New Mexico	NM	62	0	62
Oklahoma	OK	12	0	12
Texas	TX	209	0	209
Total		325	0	325

Table A-7. FTA Region 7 State-By-State Full-Size Transit ZEB Distribution**Total Buses = 122 (27% Growth from 2022)**

State		BEBs	FCEBs	Total ZEBs
Iowa	IA	23	0	23
Kansas	KS	26	0	26
Missouri	MO	57	0	57
Nebraska	NE	16	0	16
Total		122	0	122

Table A-8. FTA Region 8 State-By-State Full-Size Transit ZEB Distribution**Total Buses = 203 (15% Decrease from 2022)**

State		BEBs	FCEBs	Total ZEBs
Colorado	CO	108	0	108
Montana	MT	24	0	24
North Dakota	ND	0	0	0
South Dakota	SD	0	0	0
Utah	UT	57	0	57
Wyoming	WY	14	0	14
Total		203	0	203

Table A-9. FTA Region 9 (Without California) State-By-State Full-Size Transit ZEB Distribution**Total Buses = 195 (27% Growth from 2022)**

State		BEBs	FCEBs	Total ZEBs
Arizona	AZ	40	12	52
Hawaii	HI	52	7	59
Nevada	NV	64	10	74
Guam	GU	10	0	10
Total		166	29	195

Table A-10. California (FTA Region 9) Full-Size Transit ZEB Distribution**Total Buses = 1,946 (2% Decrease from 2022)**

State		BEBs	FCEBs	Total ZEBs
California	CA	1,670	276	1,946

Table A-11. FTA Region 10 State-By-State Full-Size Transit ZEB Distribution

Total Buses = 381 (33% Growth from 2022)

State		BEBs	FCEBs	Total ZEBs
Alaska	AK	12	0	12
Idaho	ID	40	0	40
Oregon	OR	115	0	115
Washington	WA	212	2	214
Total		379	2	381