ZEROING IN ON ZEBS

THE ADVANCED TECHNOLOGY TRANSIT BUS INDEX

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A CALSTART Report
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www.calstart.org

This document is based on information gathered on September 27th, 2019. This is the second edition of this document.

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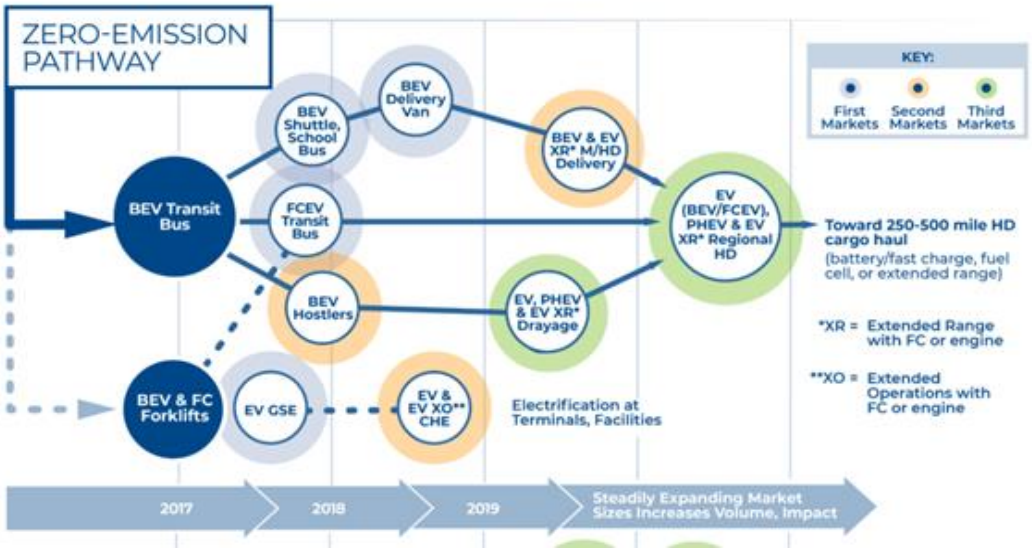
Executive Summary

Since the creation of the Clean Air Act, the federal government has been working with public and private organizations to reduce the amount of pollution released into the atmosphere. Transit buses have historically and predominantly operated on diesel fuel. Although buses produce less smog per capita than cars, they still release toxic fumes like nitrous oxide directly into urban communities.

Between 2013 and 2019, the Federal Transit Administration (FTA) has distributed over $356 million for hybrids, battery electric, and hydrogen fuel cell buses via the Low or No-emission Bus Program. State-level grant programs, such as California's Transit and Intercity Rail Capital Program (TIRCP), have also supported the adoption of zero-emission buses (ZEBs). Additionally, money from the 2016 Volkswagen settlement has been made available to states to purchase zero-emission vehicles. Over the last decade, the rise in ZEBs has increased across the country. The number of ZEBs purchased by transit agencies, universities, and private entities has continued to grow as these organizations are continuously taking advantage of the evolving electric and fuel cell vehicle technology.

However, quantifying this increase has been difficult. Funding bodies like the FTA and TIRCP have tracked the number of buses they've supported, but do not assess how many ZEBs exist overall. Some state agencies, like the California Air Resources Board (CARB), have produced high quality maps of where ZEBs are, but only within their jurisdiction or accounting for a particular technology rather than an across the board index of all types of ZEBs. Tracking this data nationally is an important exercise because it helps offers important context into the United States' progress toward adopting this critical technology. ZEBs are a foundational commercial vehicle market segment where zero-emission and near-zero technology is most likely to succeed first and can also contribute to the development of vehicles in other segments.



As shown in the graphic above, developed by CALSTART for its Global Commercial Drive to Zero program, the technologies/components found in battery electric transit buses can be used in electric shuttle and school buses, electric delivery vans, electric hostlers and other vehicles

This report seeks to remedy this problem. Zero-emissions buses are still relatively new in the transit world. As this form of transportation technology expands, it's important to keep track of the transition from buses that run on fossil fuels and near-zero-emission fuels, to ones that are entirely zero-emissions. Through extensive research and outreach, this report aims to do exactly that. Enclosed is a breakdown of all zero-emission buses, categorized by battery electric buses and hydrogen fuel cell buses, for every state in the US. A list of transit agencies who are actively operating, ordering, or have received funding for ZEBs is shown next. Lastly, a map of the country, as well as a close-up view of every state, is displayed with all the aforementioned transit agency's logos.

Results and Analysis of Survey

As of September 27th, 2019, there are:

- Battery Electric Buses (BEBs): 2184
- Hydrogen Fuel Cell Buses (FCBs): 71
- Total Zero-emission Buses (ZEBs): 2255

Zero-emission buses nationally have grown to over 2000 buses on the road or on order, an increase of 36 percent over the last calendar year. The region of the country with the most buses was the West Coast (Washington, Oregon, and California), with over half in that region alone. California had the highest number of ZEBs with over 1000. The median number of ZEBs per transit property nationwide was six, while the median number in California was nine. Total, there were 202 transit agencies that had ZEBs or had them on order in the United States. Of those 202, 56 of them are in California. Over 60 new transit agencies across the country added zero-emission buses to their current fleets. States that added zero-emission buses for the first time include Arizona, Kansas, Maine, Mississippi, Rhode Island, and Wyoming.

Important Notes About This Report

1) The data for this report has been gathered primarily through award documents, press releases, phone interviews, and other methods of validation. As there is no centralized accounting of zero-emission buses, and transit agency plans for adoption can shift and/or be delayed, it is important to note that figures contained should not be considered static. Data collection is ongoing, and this index will be updated annually. If you have information about a zero-emission bus deployment that is not featured in this report, please reach out to John Jackson (jjackson@calstart.org), Bryan Lee (blee@calstart.org), or Fred Silver (fsilver@calstart.org).

2) Despite becoming much more popular among transit agencies, ZEBs are still advanced technology, and they can take months, if not years, for bus manufacturers to build and deliver the vehicles. Determining what buses are operating today and what buses are on order is a function of time, and any attempt to do so would become immediately outdated. This report tracks all ZEBs known to be operating today, on order, or at least have been awarded funding for the transit agency to purchase. This report occasionally uses the acronym "TIUOO" to refer to the "Total In-Use or On-Order" number of ZEBs, referring to the number of buses that are active on the roads and currently on-order to be delivered in the future.

3) This report counts the ZEBs known as of September 27, 2019 as described in the previous note. All future versions of this report will similarly be a specific snapshot of a single day, date marked in the title of the report.

4) Zero-emission transit buses that are privately owned and not being used for transit revenue service are also counted in this report.

State-By-State Zero-emission Bus Distribution

State		Battery Electric Buses	Fuel Cell Buses	Total Zero-emission Buses
Alabama	AL	1	0	1
Alaska	AK	1	1	2
Arizona	AZ	3	0	3
Arkansas	AR	0	0	0
California	CA	964	52	1016
Colorado	CO	73	0	73
Connecticut	CT	6	0	6
Delaware	DE	16	0	16
District of Columbia	DC	14	0	14
Florida	FL	142	0	142
Georgia	GA	53	0	53
Hawaii	HI	28	2	30
Idaho	ID	2	2	4
Illinois	IL	73	0	73
Indiana	IN	44	0	44
Iowa	IA	5	0	5
Kansas	KS	10	0	10
Kentucky	KY	18	0	18
Louisiana	LA	11	0	11
Maine	ME	0	1	1
Maryland	MD	30	0	30
Massachusetts	MA	16	0	16
Michigan	MI	8	1	9
Minnesota	MN	27	0	27
Mississippi	MS	1	0	1
Missouri	MO	11	0	11
Montana	MT	4	0	4
Nebraska	NE	6	0	6
Nevada	NV	30	0	30
New Hampshire	NH	0	0	0
New Jersey	NJ	15	0	15
New Mexico	NM	25	0	25
New York	NY	40	0	40
North Carolina	NC	54	0	54
North Dakota	ND	0	0	0
Ohio	OH	24	12	36

State		Battery Electric Buses	Fuel Cell Buses	Total Zero-emission Buses
Oklahoma	OK	4	0	4
Oregon	OR	20	0	20
Pennsylvania	PA	37	0	37
Rhode Island	RI	9	0	9
South Carolina	SC	24	0	24
South Dakota	SD	0	0	0
Tennessee	TN	12	0	12
Texas	TX	38	0	38
Utah	UT	19	0	19
Vermont	VT	4	0	4
Virginia	VA	19	0	19
Washington	WA	211	0	211
West Virginia	WV	0	0	0
Wisconsin	WI	21	0	21
Wyoming	WY	8	0	8

Transit Properties with Battery Electric or Fuel Cell Transit Buses

Total # of Transit Agencies = 202

State	Transit Agency
AL	Alabama A&M University
AL	Birmingham-Jefferson County Transit Authority (BJCTA MAX)
AK	Alaska Department of Transportation & Public Facilities
AZ	City of Tucson
CA	Airline Coach Services (2019)
CA	Alameda-Contra Costa Transit District (AC Transit)
CA	Anaheim Resort Transportation
CA	Anteater Express (University of California, Irvine)
CA	Arvin Transit
CA	AVTA
CA	Big Blue Bus
CA	Bruin Bus (University of California, Los Angeles)
CA	California State University Fresno
CA	Central Contra Costa Transit Authority (CCTA / County Connection)
CA	City of San Jose
CA	Fairfield and Suisun Transit (FAST)
CA	Foothill Transit
CA	Fresno Area Express (FAX)
CA	Fresno County Rural Transit
CA	Golden Empire Transit District (GETbus)
CA	GTrans
CA	Humboldt Transit Authority
CA	LA Metro
CA	LADOT
CA	Long Beach Transit
CA	Marguerite (Stanford University)
CA	Marin Transit
CA	Modesto Transit
CA	Montebello
CA	Monterey-Salinas Transit
CA	Napa Valley Transportation Authority
CA	North County Transit District
CA	Norwalk Transit System
CA	Orange County Transportation Authority

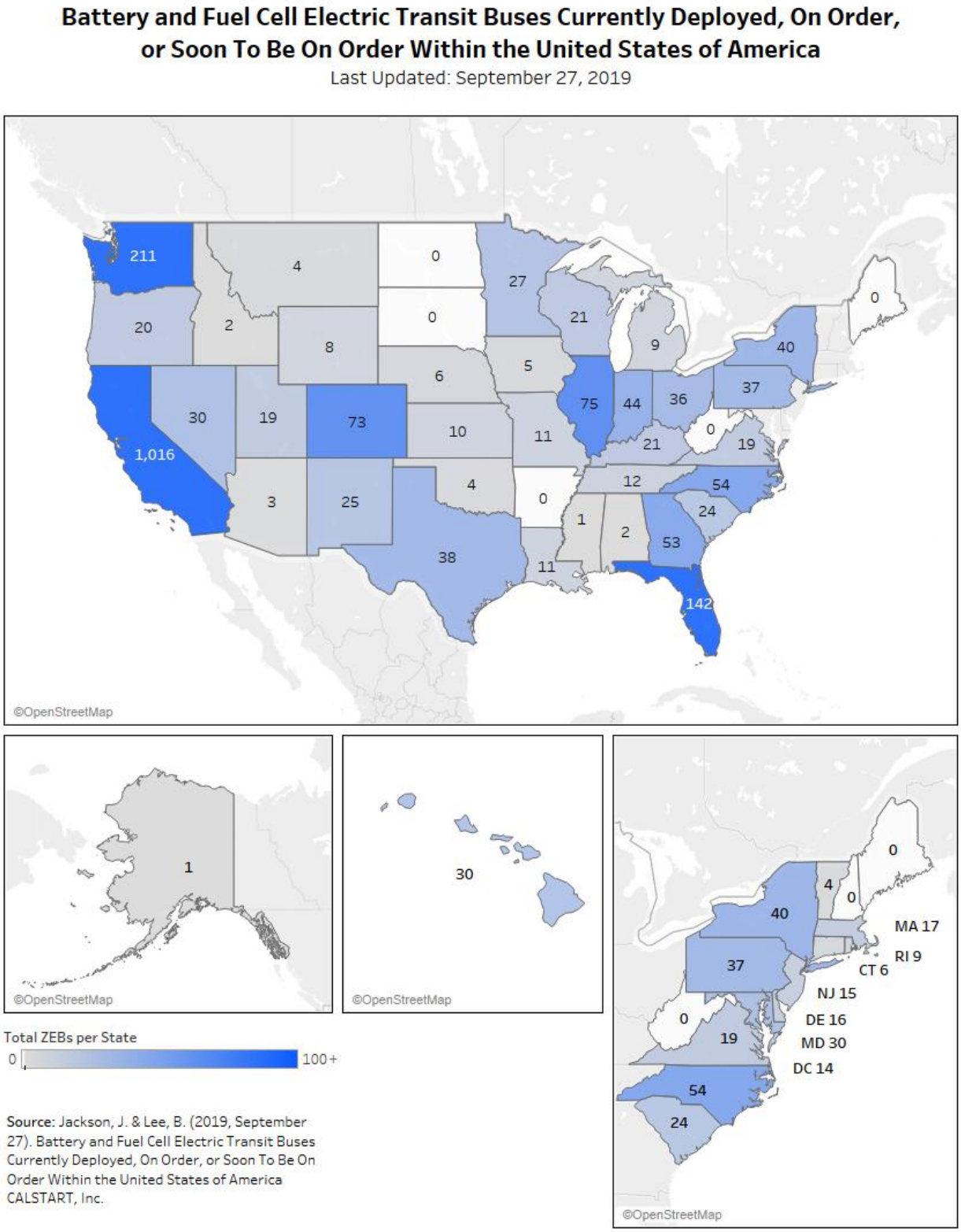
CA	Porterville Transit
CA	Redding Area Bus Authority
CA	Roseville Transit
CA	Sacramento Airport
CA	Sacramento Regional Transit District
CA	San Diego Metropolitan Transit System
CA	San Francisco International Airport
CA	San Francisco Municipal Transportation Agency (SF Muni)
CA	San Joaquin Regional Transit District
CA	San Jose Airport
CA	San Mateo County Transit District
CA	Santa Barbara Metropolitan Transit District
CA	Santa Clara Valley Transportation Authority
CA	Santa Cruz Metropolitan Transit Districts
CA	Santa Monica Big Blue Bus
CA	Santa Rosa City Bus
CA	Solano County Transit
CA	Sonoma County Transit
CA	SunLine Transit
CA	Tri Delta Transit (Antioch Transit/Eastern Contra Costa Transit Authority)
CA	University of California, Irvine
CA	University of California, San Francisco
CA	Victor Valley Transit Authority
CA	Yosemite National Park
CA	Visalia Transit
CA	We Drive U, Inc.
CO	City of Boulder (GoBoulder)
CO	City of Colorado Springs (Mountain Metro Transit)
CO	Eagle County Transit (ECO Transit)
CO	City of Fort Collins (Transfort)
CO	Denver RTD
CO	State of Colorado Department of Transportation
CT	Connecticut Department of Transportation
DC	DC Circulator
DE	Delaware Transit Corporation
FL	Broward County
FL	City of Tallahassee
FL	Gainesville RTS
FL	Jacksonville Transportation Authority
FL	LYNX
FL	Miami-Dade County
FL	Pinellas Suncoast Transit Authority

FL	StarMetro
GA	Chatham Area Transit Authority
GA	Georgia Department of Transportation
GA	Metropolitan Atlanta Rapid Transit Authority (MARTA)
GA	University of Georgia
HI	County of Hawaii (Hele-On)
HI	City and County of Honolulu
HI	Daniel K. Inouye International Airport
HI	JTB Hawaii
HI	State of Hawaii Department of Transportation
IA	CyRide - Iowa State University
IA	Des Moines Area Regional Transit Authority (DART)
ID	Mountain Rides Transportation Authority
IL	601 W Companies, LLC
IL	Bloomington-Normal Public Transit System
IL	Champaign-Urbana Mass Transit
IL	Chicago Transit Authority
IL	Greater Peoria Mass Transit District
IL	JLL
IL	Quad Cities Metrolink
IL	SL PRU, LLC
IN	Indianapolis Airport
IN	IndyGo
KS	City of Wichita
KS	Topeka Metro
KY	Lextrans
KY	TARC
LA	Capital Area Transit Systems (CATS)
LA	City of Shreveport
LA	Lafayette City-Parish Consolidated Government
MA	Martha's Vineyard Transit Authority
MA	Massachusetts Bay Transportation Authority
MA	Pioneer Valley Transit Authority
MA	Worcester Regional Transit Authority
MD	Maryland Department of Transportation
MD	Montgomery County, Maryland
MD	Prince George's County
MD	Regional Transportation Agency
MD	TransIT (Frederick County)
MI	Blue Water Area Transportation Commission
MI	Detroit Department of Transportation
MI	Flint Mass Transportation Authority

MN	City of Rochester
MN	Duluth Transit Authority
MN	Metro Transit
MO	City of Columbia
MO	St Louis Metro Transit
MS	Coast Transit Authority
MT	Missoula Urban Transportation District
MT	University of Montana
NC	Chapel Hill Transit
NC	Charlotte Douglas International Airport
NC	City of Asheville
NC	City of Durham
NC	Duke University
NC	Greensboro Transit Authority
NC	Raleigh-Durham International Airport
NC	RaleighGo
NC	Research Triangle Regional Public Transportation Authority
NE	City of Lincoln
NJ	Academy Express LLC
NJ	New Jersey Transit
NM	Atomic City Transit
NM	Albuquerque Rapid Transit
NM	ABQ Ride
NM	City of Las Cruces
NV	Regional Transportation of Washoe County
NV	Tahoe Transportation District
NV	Washoe Regional Transportation District
NY	Capital District Transportation Authority
NY	Columbia University
NY	Niagara Frontier Transportation Authority
NY	NYCMTA
NY	Port Authority of NY and NJ
NY	Rochester Genesee Regional Transportation Authority
NY	Tompkins Consolidated Area Transit
OH	Laketran
OH	Central Ohio Transit Authority (COTA)
OH	SARTA
OK	Central Oklahoma Transportation and Parking Authority
OK	Cherokee Nation
OR	City of Wilsonville, Oregon
OR	Lane Transit District
OR	TriMet

PA	Port Authority of Allegheny County (PAAC)
PA	Southeastern Pennsylvania Transportation Authority
RI	Rhode Island Public Transit Authority
SC	Berkeley-Charleston Dorchester Council of Government
SC	Chareleston Area Regional Transportation Authority
SC	City of Rock Hill
SC	City of Seneca and Oconee County
SC	Clemson Area Transit
SC	Greenville Transit Authority
TN	Chattanooga Area Regional Transportation Authority
TN	Nashville Metropolitan Transit Authority (Nashville MTA)
TX	Capital Metropolitan Transportation Authority
TX	City of Lubbock/Citibus
TX	City of McAllen
TX	Dallas Area Rapid Transit Authority
TX	Port Arthur Transit
TX	VIA Metropolitan Transit
UT	Park City Transit
UT	Utah Transit Authority
VA	Alexandra (DASH)
VA	Blacksburg Transit
VA	Hampton Roads Transit
VT	Vermont Agency of Transportation
WA	BFT
WA	Chelan Douglas Public Transportation Benefit Area
WA	Clark County Public Transit Benefit Area Authority (C-Tran)
WA	Everett Transit
WA	Grant Transit Authority
WA	King County Metro
WA	Kitsap Transit
WA	Metro Transit
WA	Pierce Transit
WA	Spokane (STA)
WA	Valley Transit
WA	Whatcom Transportation Authority
WI	City of Madison
WI	City of La Crosse
WI	City of Merrill
WI	Milwaukee County Department of Transportation
WI	Wisconsin DOT
WI	City of Racine (Racine Transit)
WY	Southern Teton Area Rapid Transit

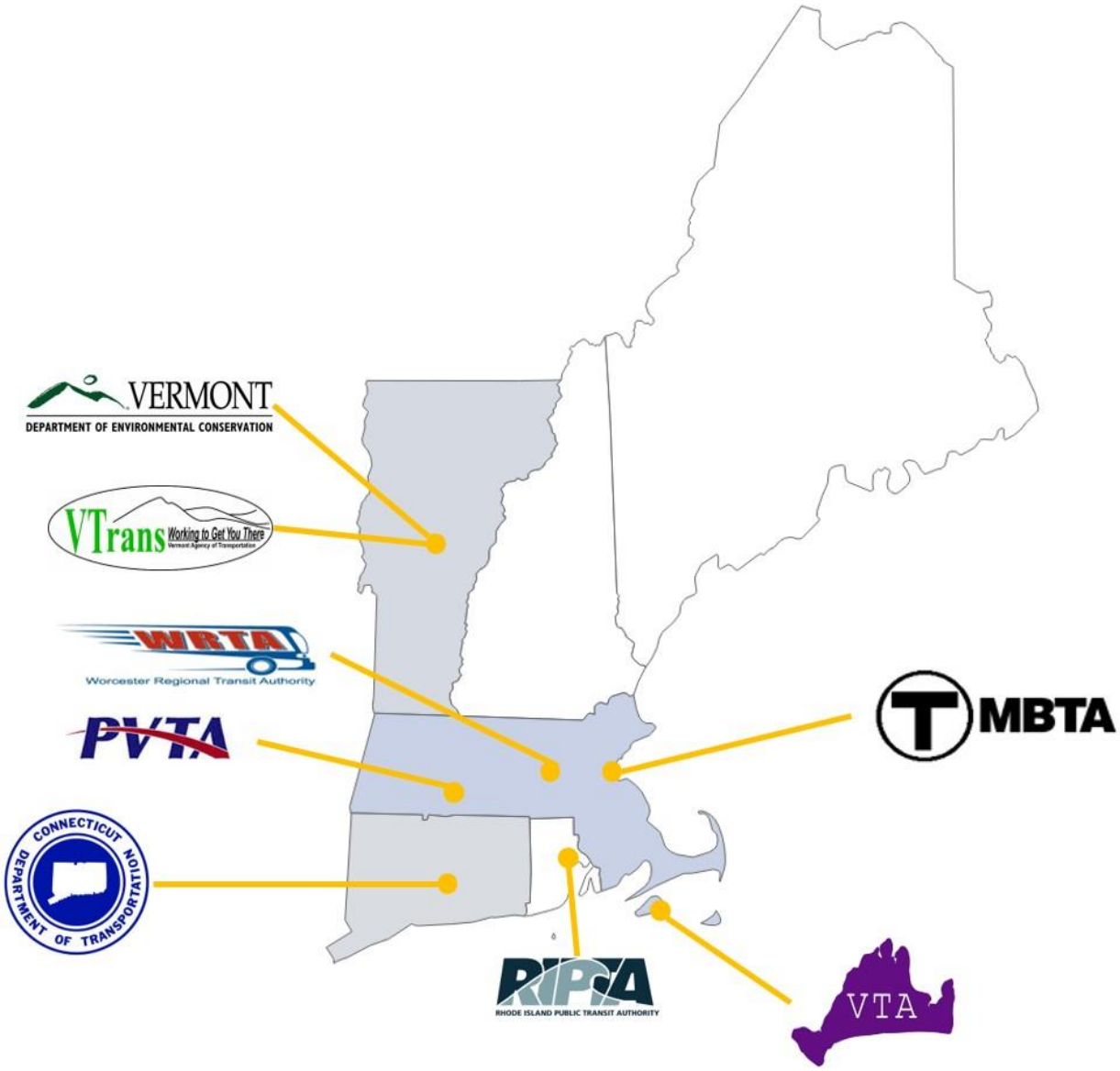
United States Zero-Emission Bus Map



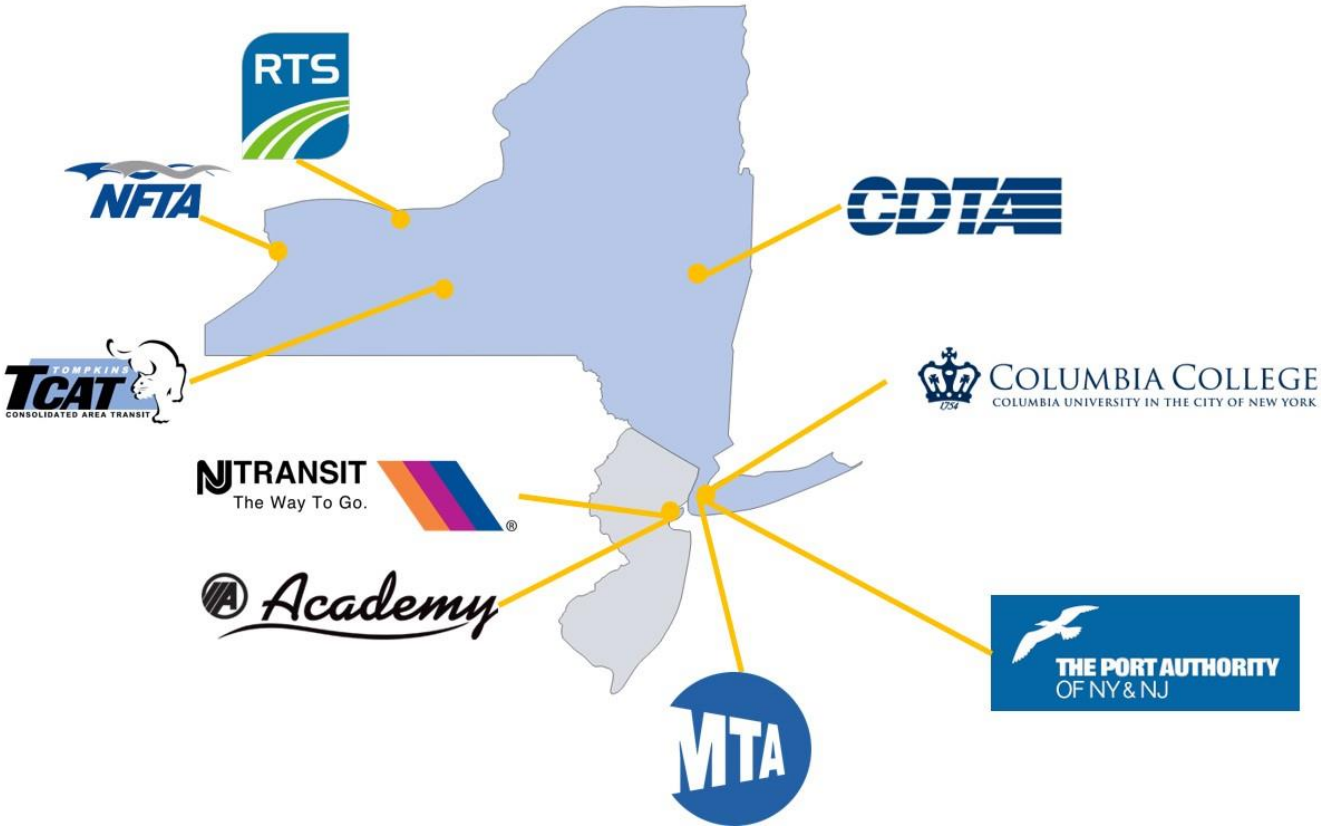
Source: Jackson, J. & Lee, B. (2019, September 27). Battery and Fuel Cell Electric Transit Buses Currently Deployed, On Order, or Soon To Be On Order Within the United States of America CALSTART, Inc.

Transit Properties Logo Map, By FTA Regions

FTA Region 1



FTA Region 2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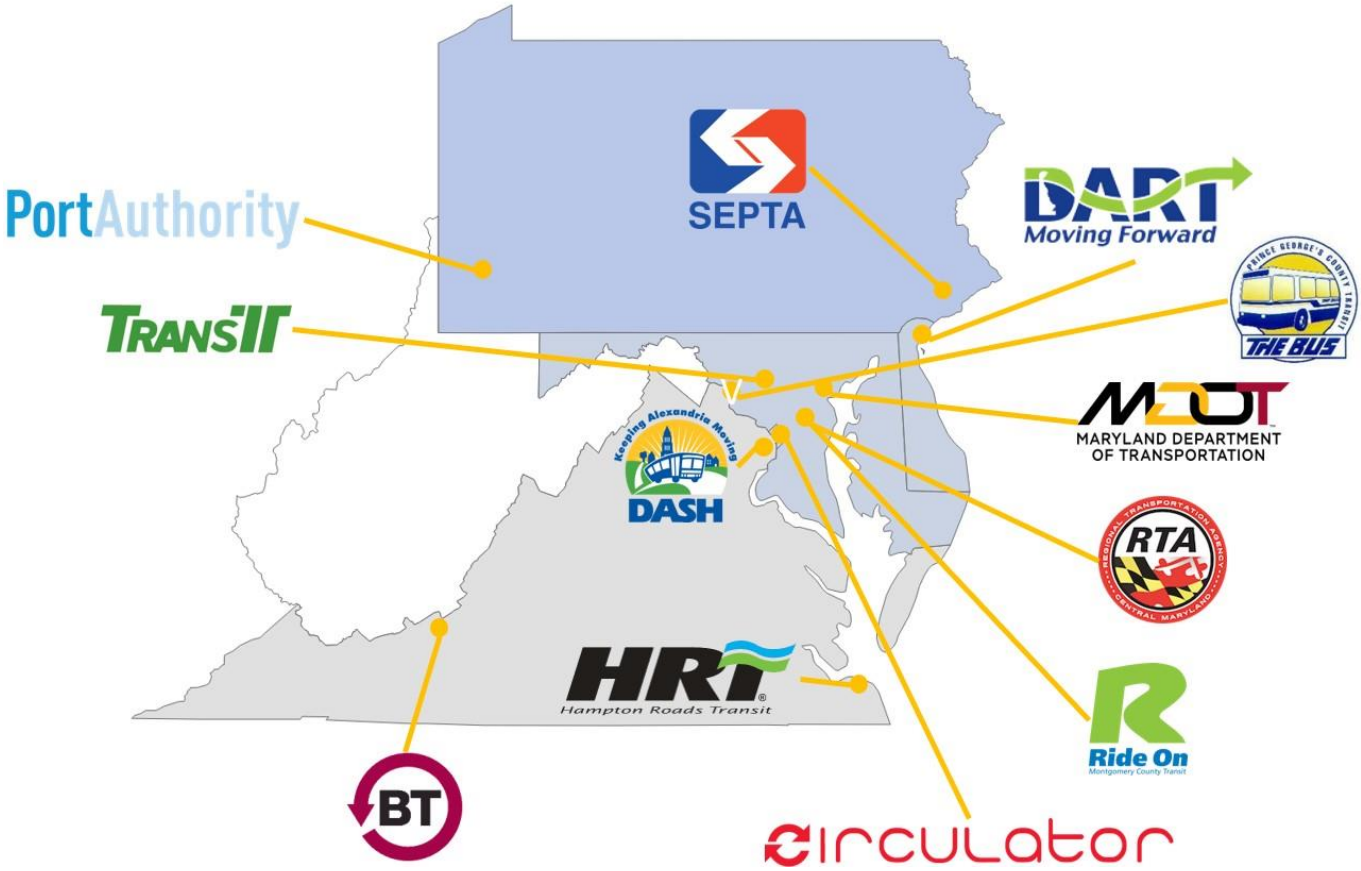
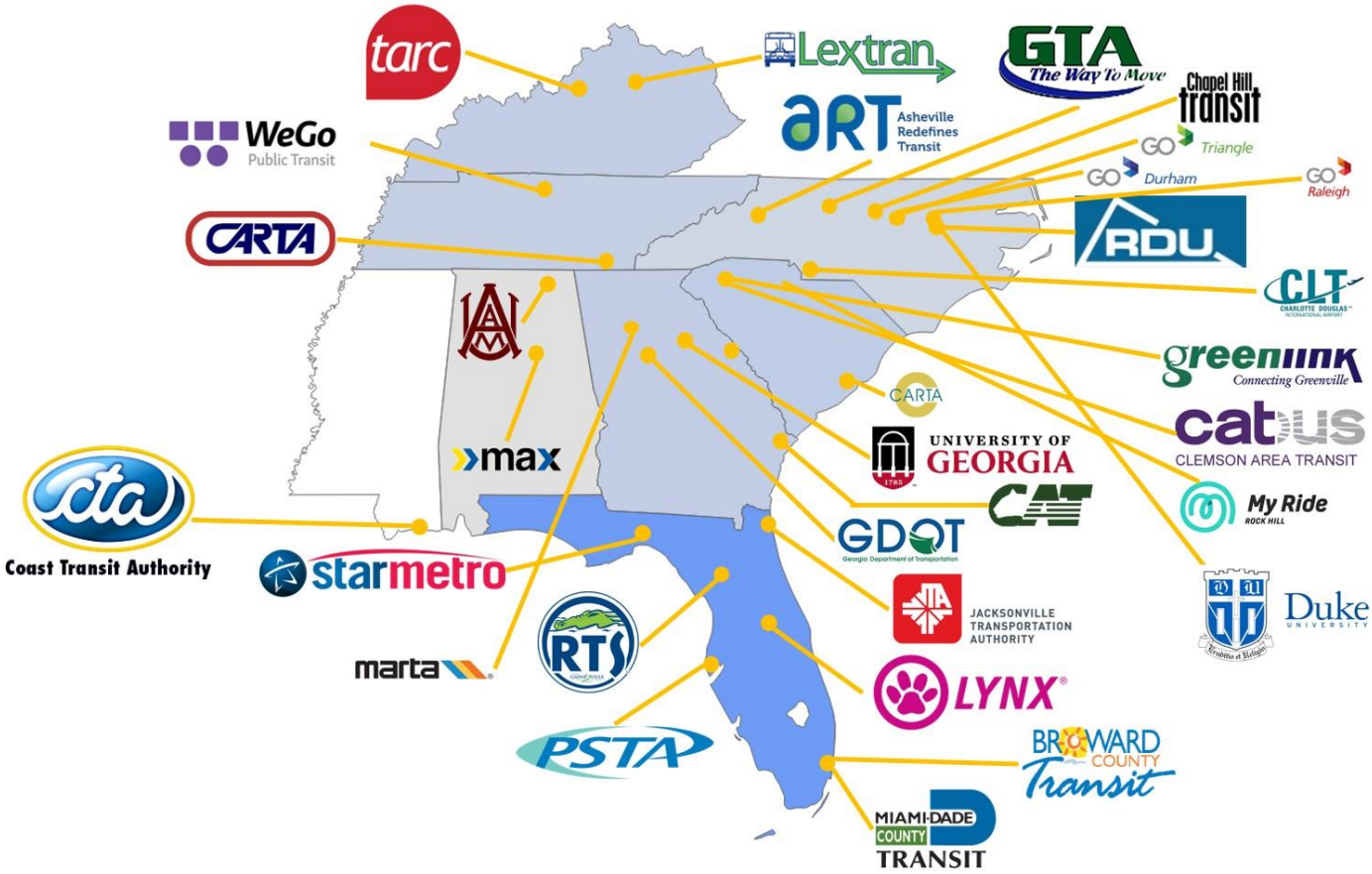
NFTA
CDTA
TOMPKINS
TCAT
CONSOLIDATED AREA TRANSIT
COLUMBIA COLLEGE
COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK
NJTRANSIT
The Way To Go.
Academy
THE PORT AUTHORITY
OF NY & NJ
MTA

FTA Region 3


PortAuthority
SEPTA
DART
Moving Forward
TRANSIT
THE BUS
MDOT
MARYLAND DEPARTMENT
OF TRANSPORTATION
Keeping Alexandria Moving
DASH
RTA
HRT
Hampton Roads Transit
Ride On
BT
circulator

FTA Region 4


tarc
Lextran
GTA
The Way To Move
Chapel Hill transit
WeGo
Public Transit
ART
Asheville
Redefines
Transit
GO Triangle
GO Durham
GO Raleigh
CARTA
RDU
CLT
CHARLOTTE DOUGLAS INTERNATIONAL AIRPORT
greenlink
Connecting Greenville
CARTA
catbus
CLEMSON AREA TRANSIT
UNIVERSITY OF GEORGIA
max
My Ride
ROCK HILL
CAT
cta
Coast Transit Authority
GDOT
Georgia Department of Transportation
starmetro
JACKSONVILLE TRANSPORTATION AUTHORITY
Duke
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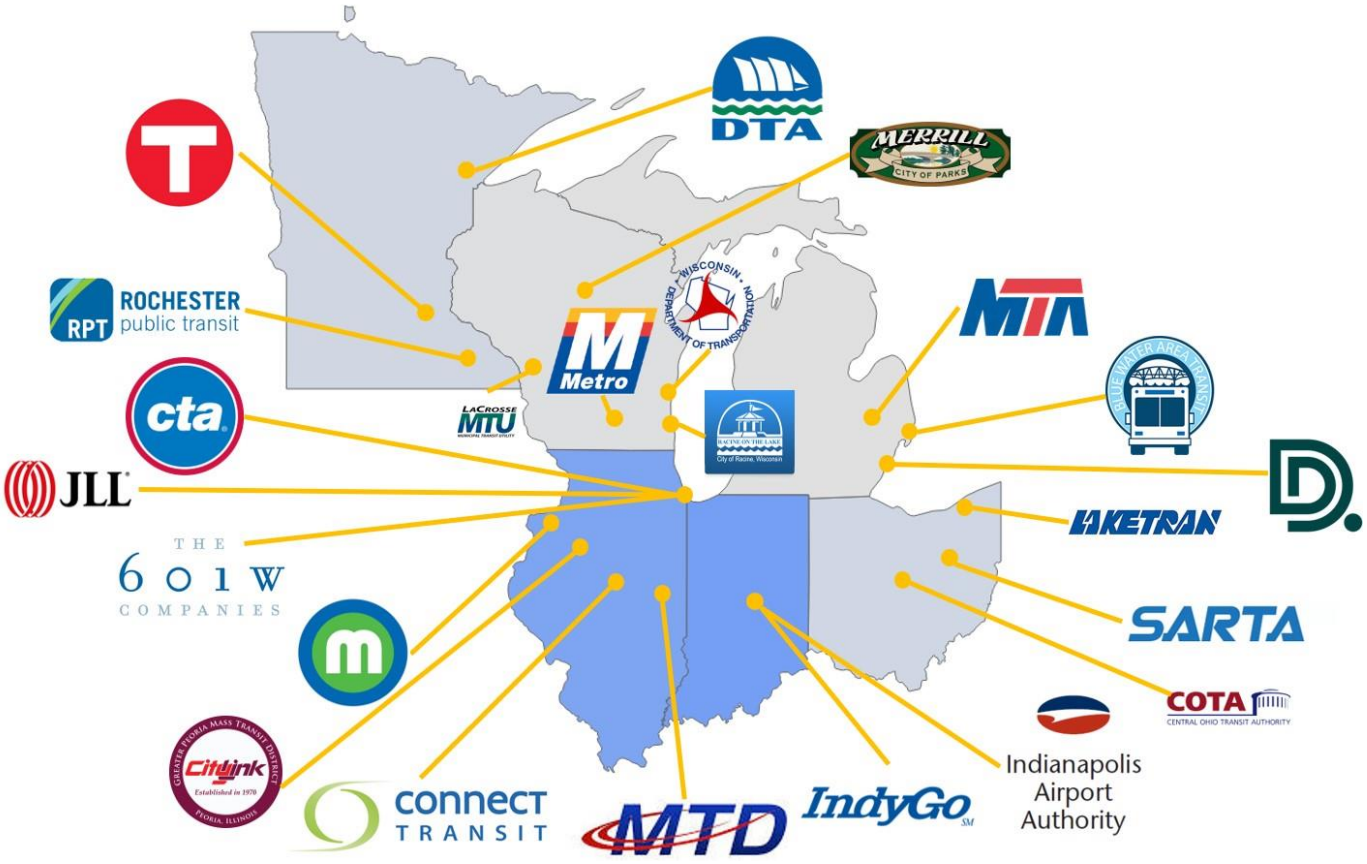
marta
LYNX
PSTA
BROWARD COUNTY Transit
MIAMI-DADE COUNTY TRANSIT

FTA Region 5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CITY OF PARKS
ROCHESTER
public transit
RPT
WISCONSIN DEPARTMENT OF TRANSPORTATION
Metro
MTA
cta
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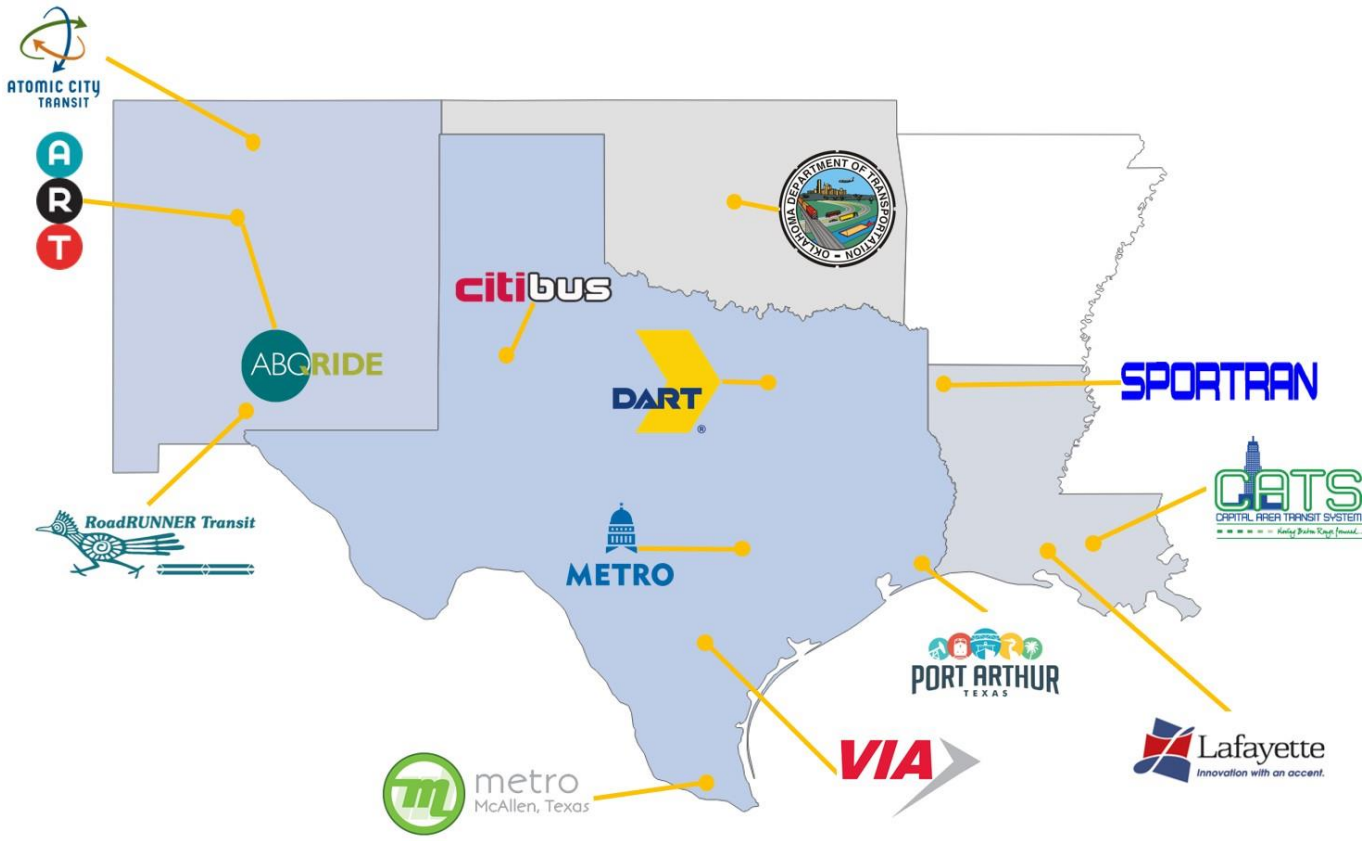
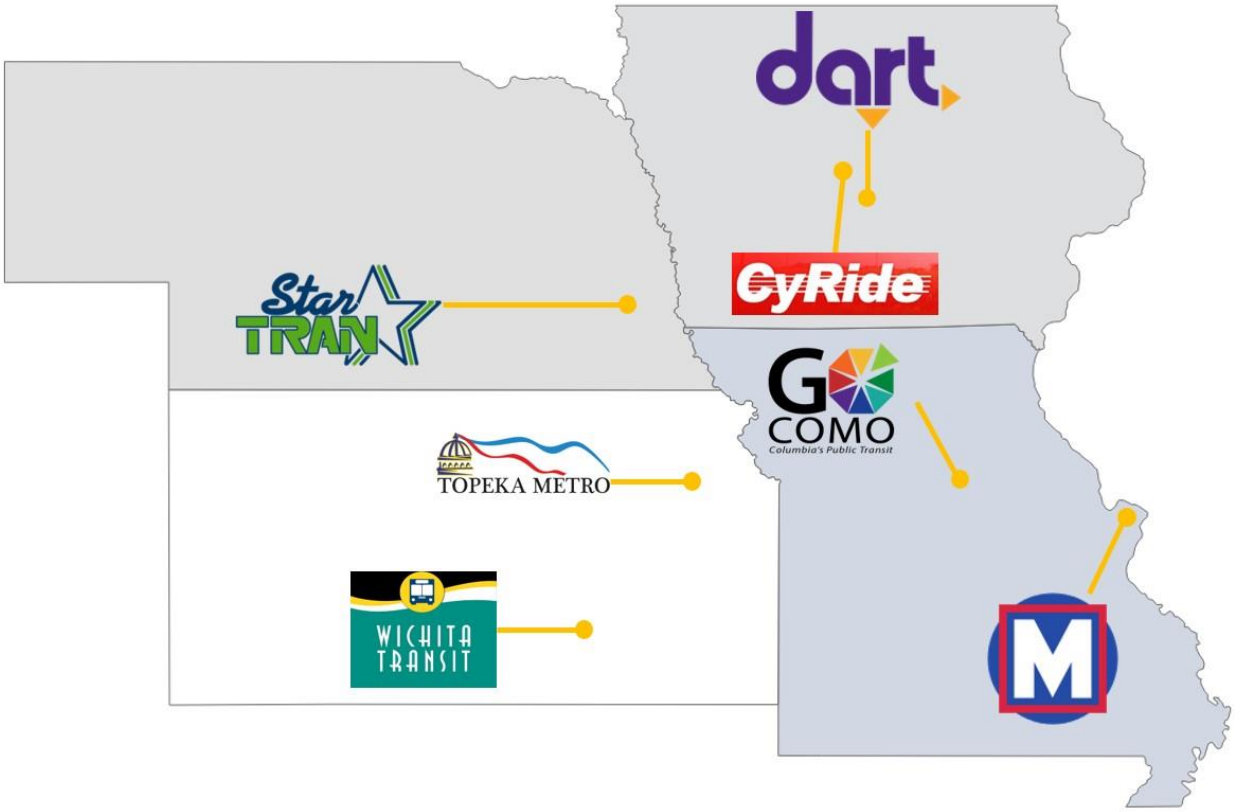
MTU
JLL
THE
601W
COMPANIES
LAKETRAN
SARTA
COTA
CENTRAL OHIO TRANSIT AUTHORITY
Citylink
connect
TRANSIT
MTD
IndyGo
Indianapolis
Airport
Authority

FTA Region 6


ATOMIC CITY TRANSIT
ART
ABQRIDE
RoadRUNNER Transit
citibus
DART
METRO
OKLAHOMA DEPARTMENT OF TRANSPORTATION
SPORTRAN
CATS
CAPITAL AREA TRANSIT SYSTEM
PORT ARTHUR
TEXAS
VIA
Lafayette
Innovation with an accent.
metro
McAllen, Texas

FTA Region 7


dart
CyRide
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GO COMO
Columbia's Public Transit
TOPEKA METRO
WICHITA TRANSIT
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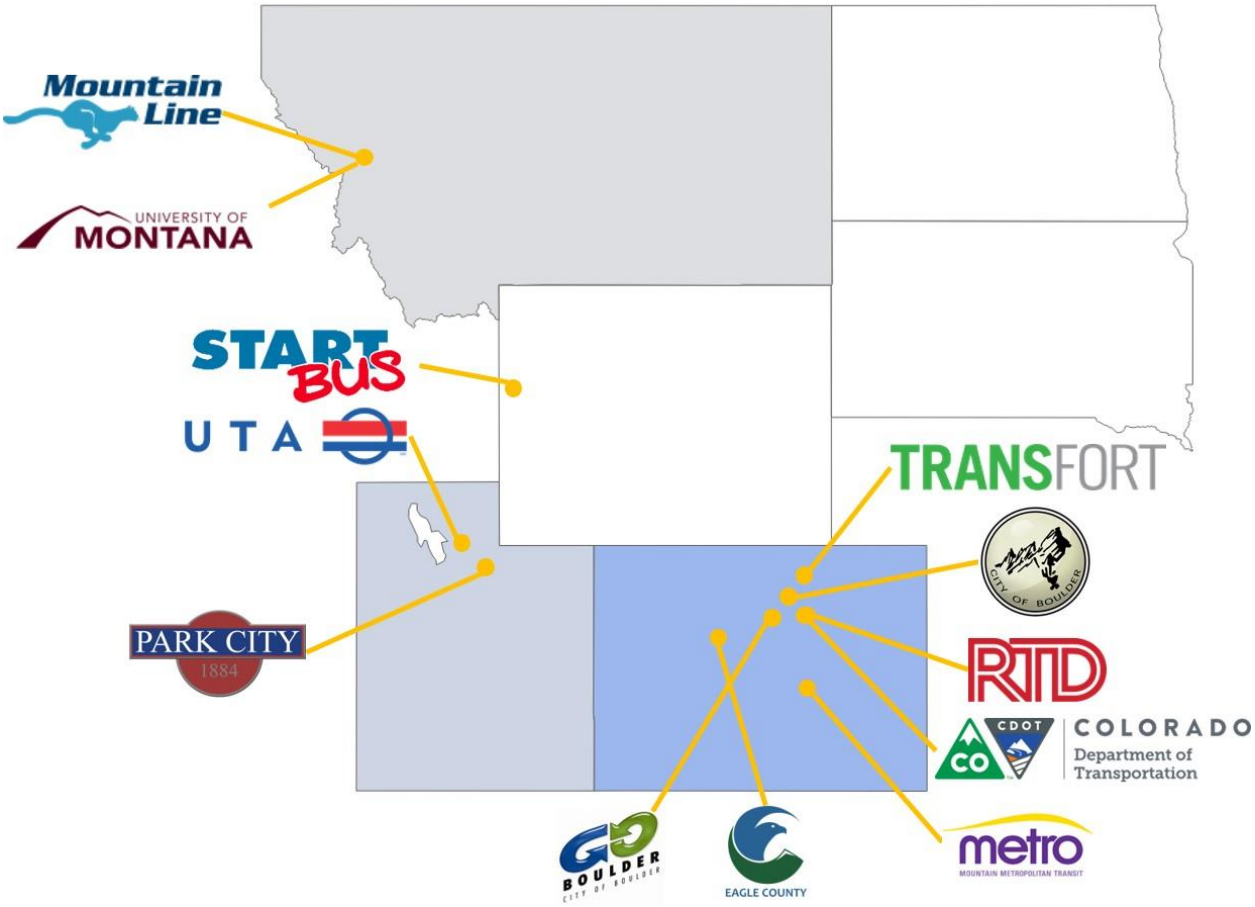
FTA Region 8


Mountain Line
UNIVERSITY OF MONTANA
START BUS
UTA
TRANSFORT
PARK CITY
1884
CITY OF BOULDER
RTD
CDOT
CO
COLORADO
Department of Transportation
GO BOULDER
CITY OF BOULDER
EAGLE COUNTY
metro
MOUNTAIN METROPOLITAN TRANSIT

FTA Region 9 (Without California)

FTA Region 9 (California)

FTA Region 10