

# Bus Procurement Cost Analysis

## Summary

This analysis examines the cost of buses for transit agencies across the county. Specifically, to observe the variation of bus cost for propulsion type with a focus on Zero Emission Buses (ZEB).

Data was compiled from three data sources:

1. FTA Bus and Low- and No-Emission Grant Awards press release (federally funded, nationwide data)
2. TIRCP project data (state-funded, California only data)
3. DGS usage report for all procurements from California agencies purchasing from New Flyer and Portera Inc.

The initial dataset included nearly 300 projects. It was reduced to 88 projects after applying criteria to exclude non-bus related work. Projects involving the construction of new facilities, training programs, or the procurement of non-bus items such as trains and ferries were excluded. The final dataset comprised only projects focused on bus procurement. The remaining projects, on average, procured 15.0 buses and cost \$9416141.0.

These projects were aggregated against propulsion type and bus size type, and categorized by ZEB and non-ZEB.

### **ZEB projects are categorized into the following propulsion types:**

- zero-emission (not specified)
- electric (not specified)
- battery electric bus (BEB)
- fuel cell electric bus (FCEB)

### **Non-ZEB projects include the following propulsion types:**

- compressed natural gas (CNG)
- ethanol
- low-emission (hybrid, propane)
- diesel
- gas

These projects were broken down and visualized in the sections below.

# Charts and Tables

The following visuals display the kinds of variations to bus cost that transit agencies face.

## Overall summary totals by data source

	source	number_of_projects	bus_count	total_cost	cost_per_bus
0	dgs	36.0	236.0	250112853.0	1059800
1	fta	43.0	883.0	391257025.0	443099
2	tircp	9.0	233.0	187250513.0	803650
3	grand total	88.0	1352.0	828620391.0	612884

Broken down further, we can observe the type of ZEB projects by data source.

		number_of_projects	bus_count	total_cost	cost_per_bus
source	prop_type				
dgs	BEB	30	163.0	167232489	1025966
	FCEB	6	73.0	82880364	1135347
fta	FCEB	2	29.0	38070971	1312792
	electric (not specified)	1	8.0	10000000	1250000
tircp	electric (not specified)	2	36.0	46678000	1296611
	zero-emission bus (not specified)	5	143.0	128156513	896199

## Summary of cost by ZEB propulsion types

prop_type	number_of_projects	bus_count	total_cost	cost_per_bus
BEB	30	163	167232489	1025966
FCEB	8	102	120951335	1185797
electric (not specified)	3	44	56678000	1288136
zero-emission bus (not specified)	5	143	128156513	896199
grand total	46	452	473018337	1046500

### Summary of cost by non-ZEB propulsion types \*

prop_type	number_of_projects	bus_count	total_cost	cost_per_bus
CNG	13	252	176039140	698568
ethanol	1	9	1006750	111861
low emission (hybrid)	16	145	91824361	633271
low emission (propane)	5	44	8403969	190999
mix (zero and low emission)	2	125	36775430	294203
grand total	37	575	314049650	546173

\*The remaining buses did not specify a propulsion type

prop_type	number_of_projects	bus_count	total_cost	cost_per_bus
not specified	5	325	41552404	127853

## Which agencies had the highest and lowest ZEB cost per bus?

### Max cost\_per\_bus

transit_agency	prop_type	total_cost	bus_count	cost_per_bus
University of California - San Diego	BEB	4134000	2.000000	2067000

### Min cost\_per\_bus

transit_agency	prop_type	total_cost	bus_count	cost_per_bus
City of Wasco	zero-emission bus (not specified)	1543000	3.000000	514333

University of San Diego did not any information regarding their project. City of Wasco explained their project saying "Purchase of 3 zero-emission buses that will support Wasco's local Dia-a-Ride shuttle services to expand service to affordable housing projects and expand overall service availability by 50%".

Neither agencies describe the specifics of their buses which may explain the differences in cost per bus

## Which agencies procured the most and least amount of ZEBs?

### Max bus\_count

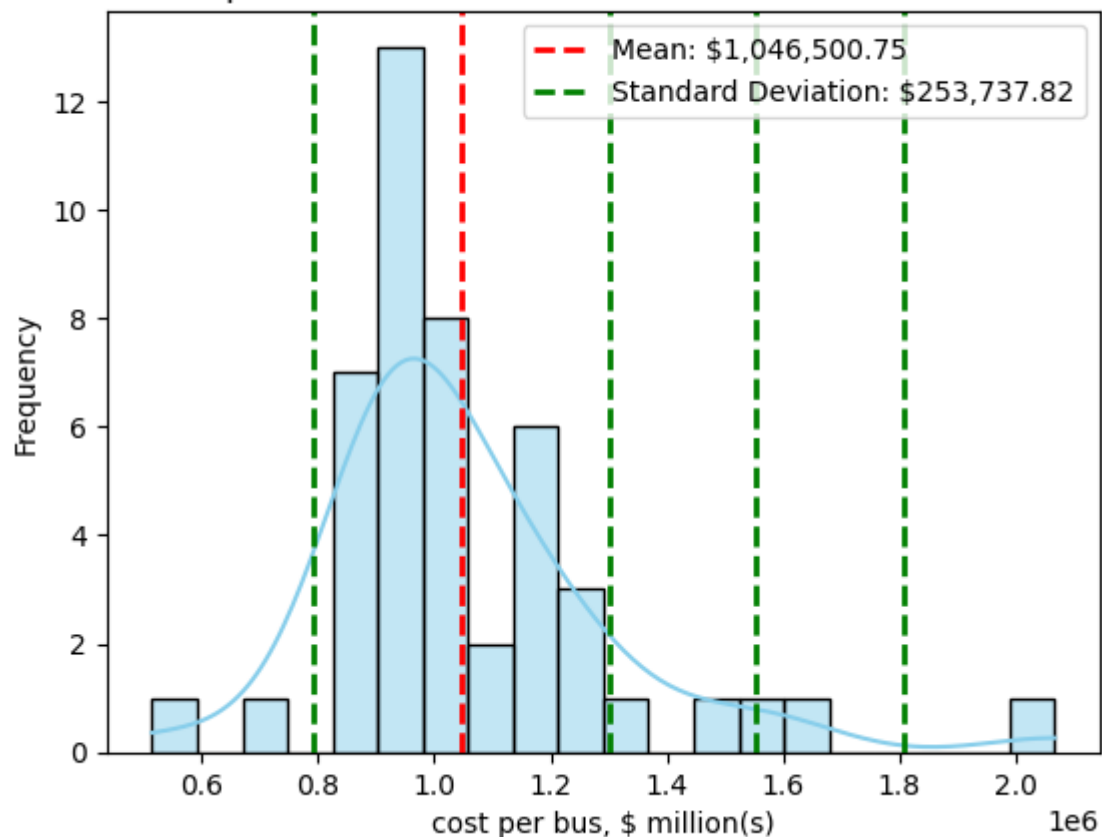
transit_agency	prop_type	total_cost	bus_count	cost_per_bus
City of Los Angeles (LA DOT)	zero-emission bus (not specified)	102790000	112.000000	917767

### Min bus\_count

transit_agency	prop_type	total_cost	bus_count	cost_per_bus
SLO TRANSIT (SAN LUIS OBISPO, CA)	BEB	847214	1.000000	847214
City of San Luis Obispo	BEB	859270	1.000000	859270

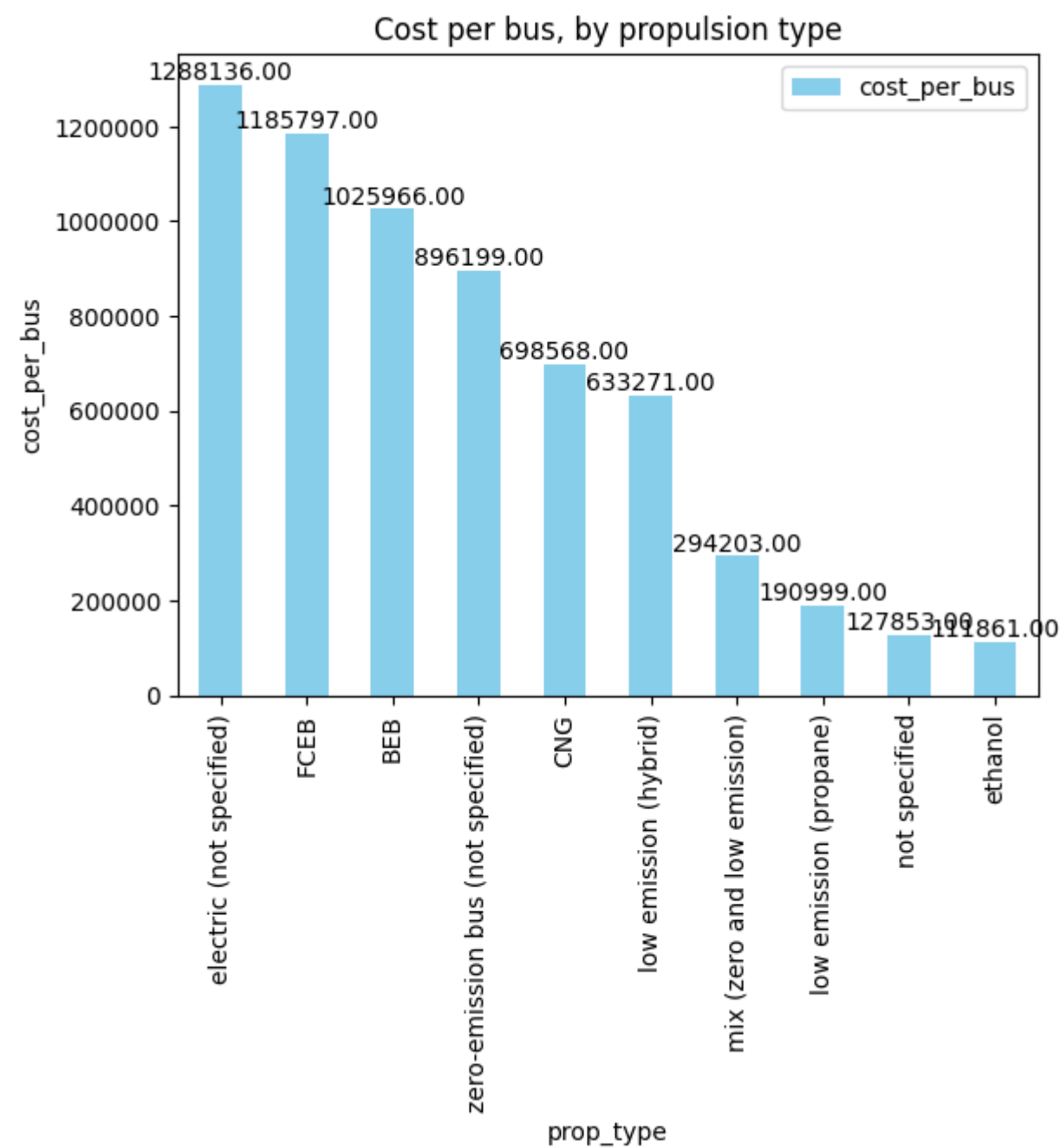
## What is the distribution of ZEB cost?

ZEB cost per bus distribution with Mean and Standard Deviation



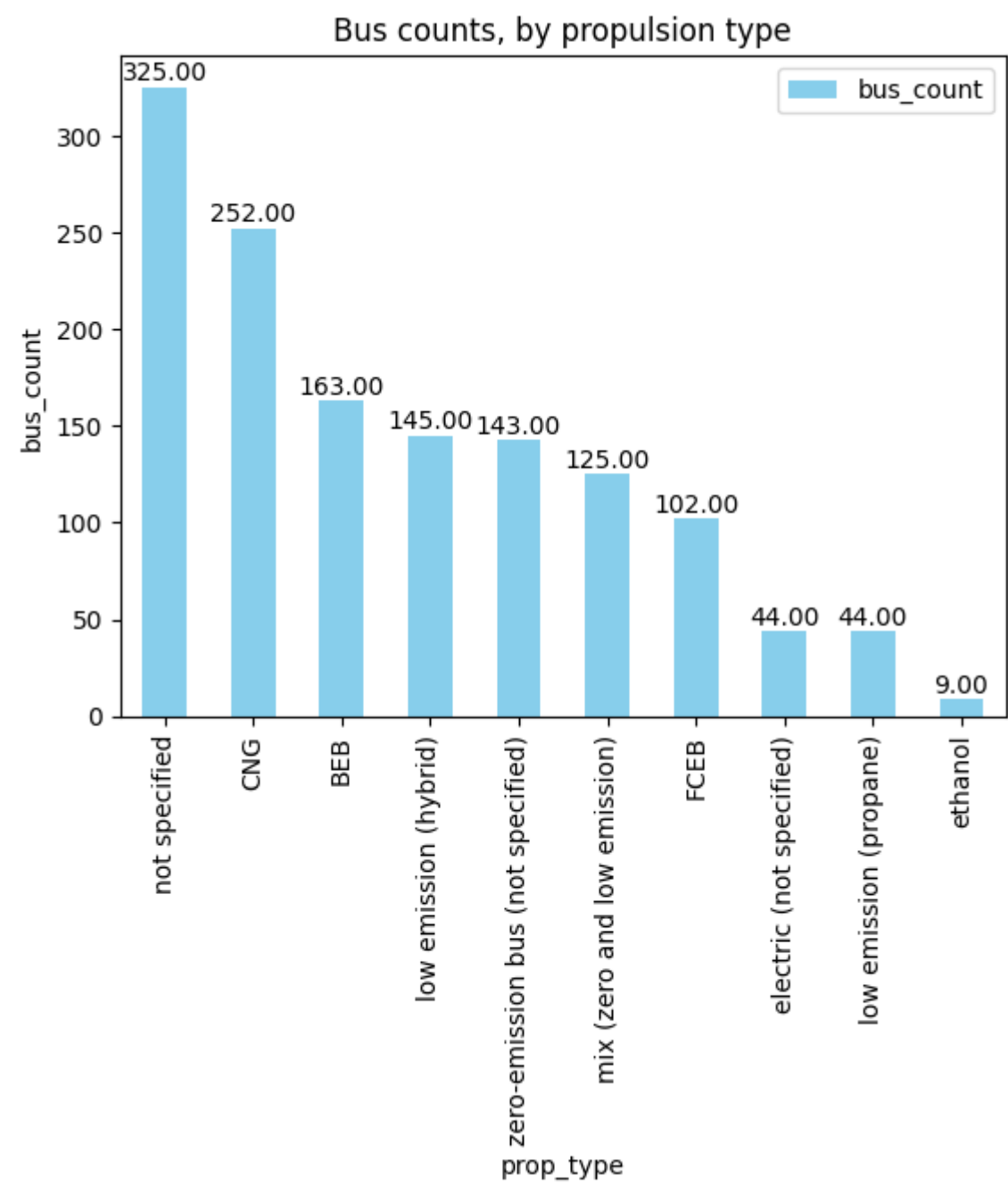
This distribution show the ZEB cost floating around **~\$1,000,000** , with only a few instances extending past +/- 1 standard deviation. As shown earlier, the lowest cost per ZEB bus was about **~\$500,000** . However it should be noted that the propulsion type for this instance did not specify exactly which type of ZEB was procured (BEB, FCEB, or otherwise). The highest cost per ZEB was about **~\$2,000,000** for BEB.

What is the cost per bus compared against all propulsion types?



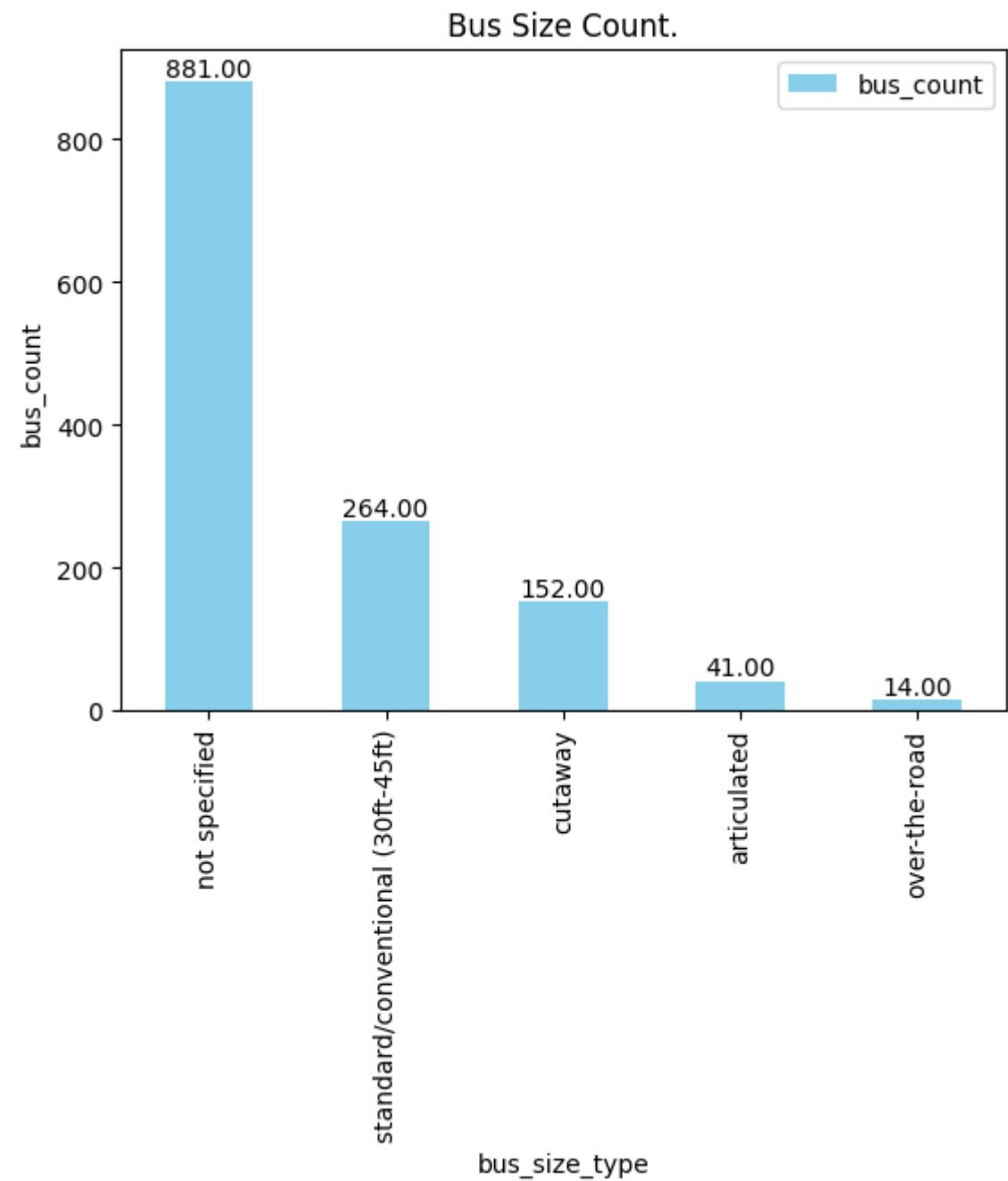
None

What is the total bus counts compared to each propulsion type?



None

What is the total bus counts compared to each bus size category?



Unfortunately, many of the projects did not specify any information indicating a bus size type. However we can breakdown other categories that provide a little more insight to bus sizes.

## What is the breakdown of ZEB Propulsion Type and Bus Size Category?

		bus_count	total_cost	cost_per_bus
prop_type	bus_size_type			
BEB	articulated	12.0	18759576	1563298
	standard/conventional (30ft-45ft)	151.0	148472913	983264
FCEB	not specified	29.0	38070971	1312792
	standard/conventional (30ft-45ft)	73.0	82880364	1135347
electric (not specified)	articulated	29.0	39478000	1361310
	not specified	15.0	17200000	1146666
zero-emission bus (not specified)	not specified	143.0	128156513	896199

We can observe in this table that, when aggregated against propulsion type, the standard bus size (30ft-45ft) is the most common size category for ZEBs

## Conclusion

Based on these findings, The average cost of a ZEB, throughout the US, is ~\$1,000,000, roughly twice the price of a conventional, non-ZEB. The most commonly procured BEBs and FCEBs are the standard 30ft-45ft category, costing ~\$980,000 and ~\$110,000 respectively. The variance in cost depends mainly on the options the Transit Agencies chooses. Highly optioned/customized buses contribute to higher cost. Unfortunately, analyzing the cost of configurable options is outside the scope of data provided.