

papermill_test_pdf

July 8, 2024

1 Bus Procurement Cost Analysis

1.1 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.

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 - fuel cell electric

Non-ZEB projects include the following propulsion types: - compressed natural gas (CNG) - ethanol - low-emission (hybrid, propane) - diesel - gas

Below is a breakdown of each data source showing the total buses and cost for each source:

	source	bus_count	total_cost	cost_per_bus
0	dgs	236.0	250112853	1059800
1	fta	883.0	391257025	443099
2	tircp	233.0	187250513	803650
3	Grand Total	1352.0	828620391	612884

2 Summary Charts and Tables

Summary of cost by ZEB propulsion types

	prop_type	bus_count	total_cost	cost_per_bus
0	BEB	163.0	167232489	1025966
1	FCEB	102.0	120951335	1185797
2	electric (not specified)	44.0	56678000	1288136

3	zero-emission bus (not specified)	143.0	128156513	896199
4	Grand Total	452.0	473018337	1046500

Summary of cost by non-ZEB propulsion types *

	prop_type	bus_count	total_cost	cost_per_bus
0	CNG	252.0	176039140	698568
1	ethanol	9.0	1006750	111861
2	low emission (hybrid)	145.0	91824361	633271
3	low emission (propane)	44.0	8403969	190999
4	mix (zero and low emission)	125.0	36775430	294203
5	Grand Total	575.0	314049650	546173

*The remaining buses did not specify a propulsion type

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

Max cost_per_bus

	transit_agency	prop_type	total_cost	bus_count \
76	University of California - San Diego	BEB	4134000	2.0
	cost_per_bus			
76	2067000			

Min cost_per_bus

	transit_agency	prop_type	total_cost	bus_count \
45	City of Wasco	zero-emission bus (not specified)	1543000	3.0
	cost_per_bus			
45	514333			

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

Max bus_count

	transit_agency	prop_type	total_cost	bus_count \
44	City of Los Angeles (LA DOT)	zero-emission bus (not specified)		
	total_cost	bus_count	cost_per_bus	
44	102790000	112.0	917767	

Min bus_count

	transit_agency	prop_type	total_cost	bus_count \
70	SLO TRANSIT (SAN LUIS OBISPO, CA)	BEB	847214	1.0
82	City of San Luis Obispo	BEB	859270	1.0
	cost_per_bus			
70	847214			
82	859270			

2.3 Which agencies had the most and least total ZEB cost?

Max total_cost

```
transit_agency      prop_type \
44 City of Los Angeles (LA DOT) zero-emission bus (not specified)
```

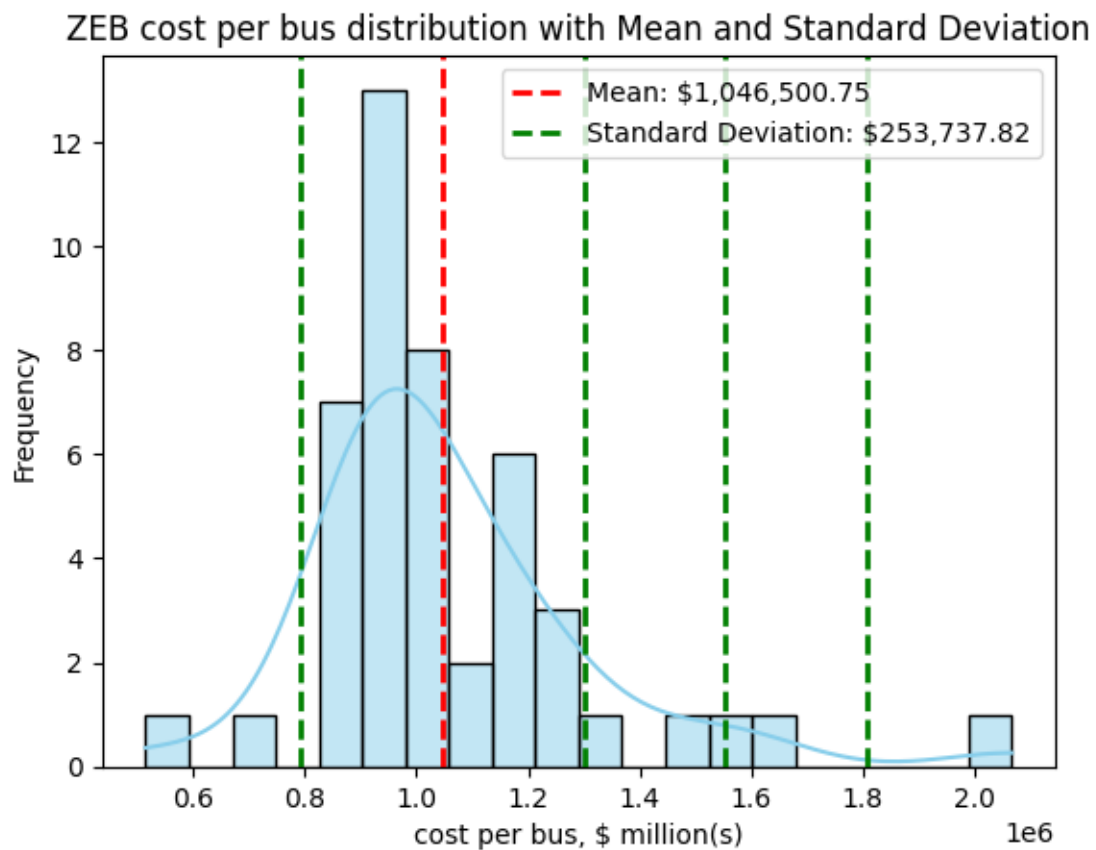
```
total_cost bus_count cost_per_bus
44 102790000    112.0    917767
```

Min total_cost

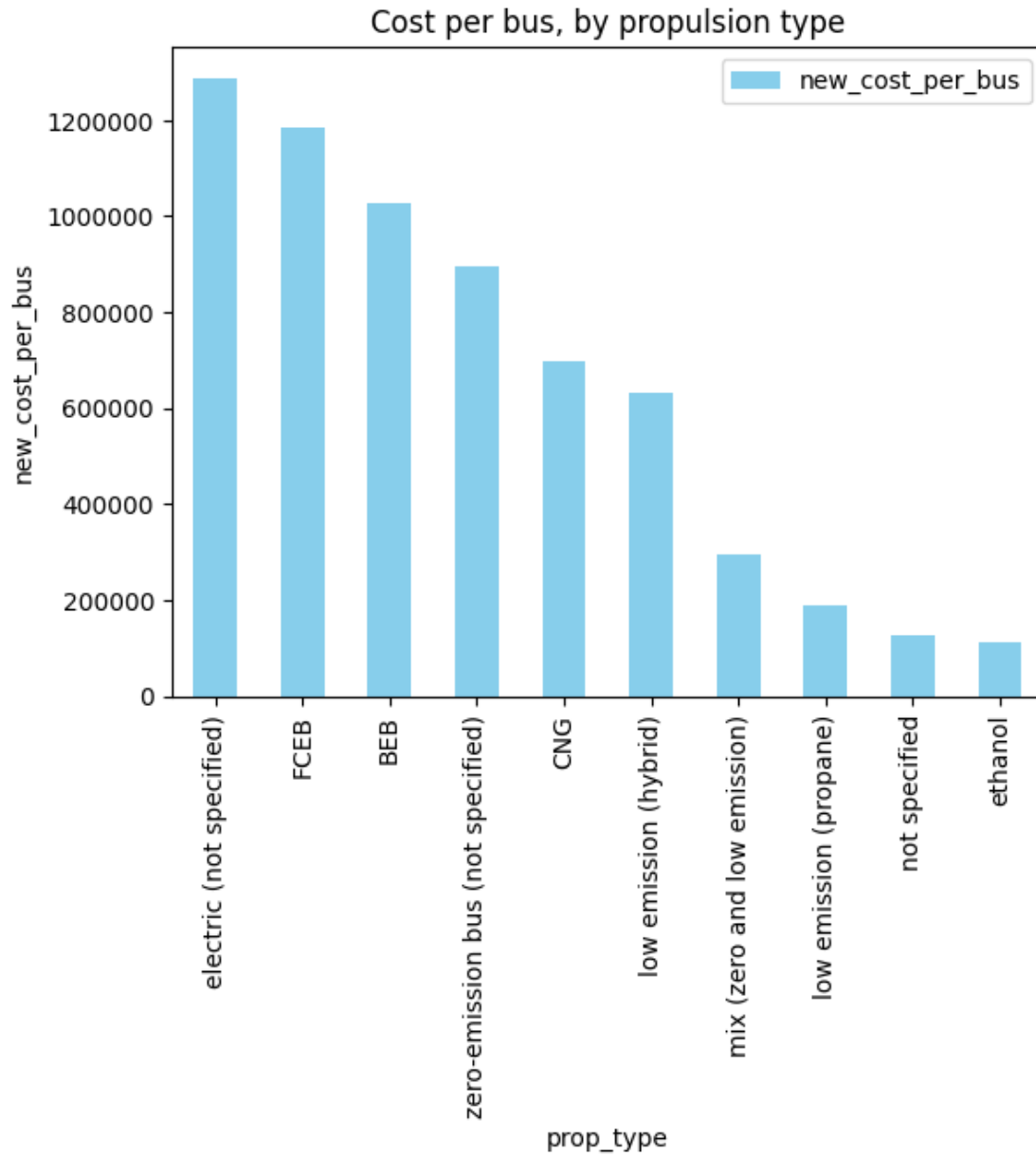
```
transit_agency prop_type total_cost bus_count \
70 SLO TRANSIT (SAN LUIS OBISPO, CA) BEB      847214      1.0
```

```
cost_per_bus
70      847214
```

2.4 What is the distribution of ZEB cost?



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

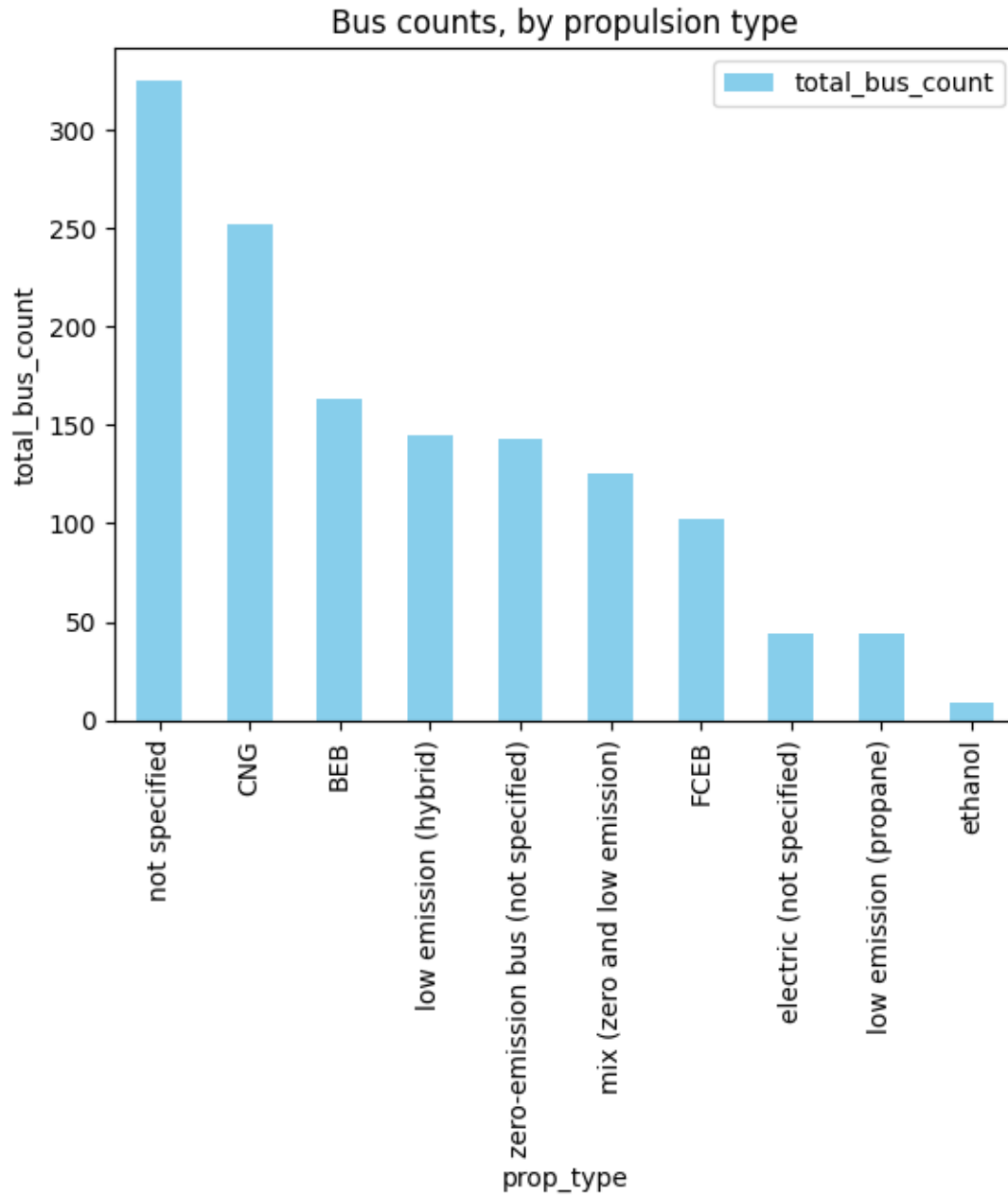


None

	prop_type	new_cost_per_bus
3	electric (not specified)	1288136
2	FCEB	1185797
0	BEB	1025966
9	zero-emission bus (not specified)	896199
1	CNG	698568
5	low emission (hybrid)	633271

7	mix (zero and low emission)	294203
6	low emission (propane)	190999
8	not specified	127853
4	ethanol	111861

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

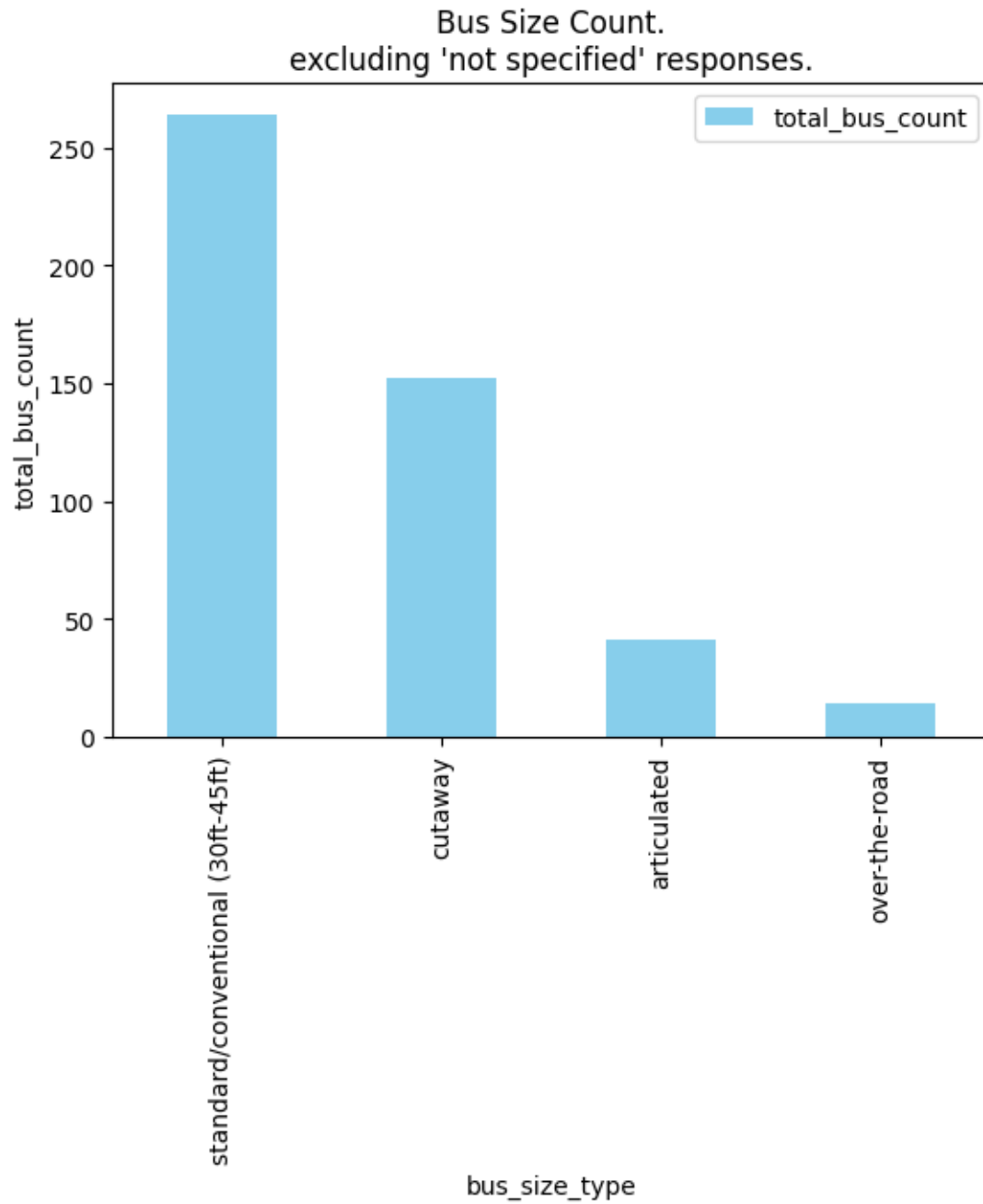


None

prop_type total_bus_count

8	not specified	325.0
1	CNG	252.0
0	BEB	163.0
5	low emission (hybrid)	145.0
9	zero-emission bus (not specified)	143.0
7	mix (zero and low emission)	125.0
2	FCEB	102.0
3	electric (not specified)	44.0
6	low emission (propane)	44.0
4	ethanol	9.0

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



None

	bus_size_type	total_bus_count
0	articulated	41.0
1	cutaway	152.0
2	not specified	881.0

3	over-the-road	14.0
4	standard/conventional (30ft-45ft)	264.0

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

		bus_count \
prop_type	bus_size_type	
BEB	articulated	12.0
	standard/conventional (30ft-45ft)	151.0
FCEB	not specified	29.0
	standard/conventional (30ft-45ft)	73.0
electric (not specified)	articulated	29.0
	not specified	15.0
zero-emission bus (not specified)	not specified	143.0

		total_cost ↴
↵ \		
prop_type	bus_size_type	
BEB	articulated	18759576
	standard/conventional (30ft-45ft)	148472913
FCEB	not specified	38070971
	standard/conventional (30ft-45ft)	82880364
electric (not specified)	articulated	39478000
	not specified	17200000
zero-emission bus (not specified)	not specified	128156513

		cost_per_bus
prop_type	bus_size_type	
BEB	articulated	1563298
	standard/conventional (30ft-45ft)	983264
FCEB	not specified	1312792
	standard/conventional (30ft-45ft)	1135347
electric (not specified)	articulated	1361310
	not specified	1146666
zero-emission bus (not specified)	not specified	896199

3 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 variance in cost depends mainly on the options the Trasnit Agencies chooses. Highly optioned/customized buses contribute to high cost. Unfortunately, analyzing the cost of configurable options is outside the scope of data provided.