Senate Bill 671 Infrastructure Needs Assessment

Infrastructure Needs Assessment Methodology and Outcomes

For the Senate Bill (SB) 671 Assessment, Commission staff defined “zero-emission freight infrastructure needs” as the electric charging and hydrogen fueling stations needed to support zero-emission trucks.

The Assessment studied four years that are benchmarks in the Advanced Clean Fleets regulation – 2025, 2030, 2035, and 2040.

For each year, three potential scenarios were created to gauge zero-emission truck demand and estimated infrastructure needs: accelerated battery electric adoption, balanced adoption (given likely fleet owner powertrain choice), and accelerated hydrogen fuel cell adoption.

Input from the workgroup, including private companies and state agencies such as the California Energy Commission and the California Air Resource Board, was used to shape the estimated powertrain adoption in each scenario. The estimated powertrain adoption is the estimated percentage split between battery electric trucks and hydrogen fuel cell electric trucks used in each scenario.

The Assessment considered the estimated cost of vehicle ownership, and how well different technology choices fit different truck use cases to estimate how many trucks would be battery electric and how many trucks would be hydrogen per scenario. California Air Resources Board vehicle estimates disaggregated by vehicle class type were used to associate different truck vehicle class types with typical use cases and cost. Exhibit 1 summarizes the key scenario assumptions.

Exhibit 1. Key Assumptions for the 3 Infrastructure Needs Scenarios

Key assumptions behind the three scenarios

	Accelerated battery electric (BEV) adoption	Balanced adoption	Accelerated hydrogen fuel cell (FCEV) adoption
Cost of ownership	**Battery electric trucks become more cost effective over time** accelerating incorporation into commercial fleets	**Balanced adoption of zero-emissions technologies** over time	**Fuel cell trucks become more cost effective over time** accelerating incorporation into commercial fleets
Technology choice	**BEV trucks and charging become viable for long haul trips**	**No predominantly used technology across use cases;** BEV continues to be used mostly for medium-duty short and regional trips, FCEV for heavy-duty and long-haul	**FCEV trucks and refueling become a viable choice for short haul trips**

Once the three scenarios were developed, the infrastructure needed to support the battery electric and hydrogen medium-duty and heavy-duty truck fleets were estimated for each scenario. Developing scenarios for zero-emission freight infrastructure needs requires estimates of the following factors:

- Total number of zero-emission medium-duty and heavy-duty vehicles on the road (assumptions are held constant across all three scenarios).
- Annual medium-duty and heavy-duty annual average statewide vehicle miles traveled by vehicle class type (assumptions are held constant across all three scenarios).
- Fuel efficiency of battery electric and hydrogen trucks (assumptions are held constant across all three scenarios).
- Mix of power train adoptions. For example, what percent of the total trucks will be battery electric? What percent will be hydrogen? The three scenarios are:
  - Accelerated battery electric adoption: Tests a higher and faster adoption of battery electric trucks.
  - Accelerated hydrogen fuel cell adoption: Tests a higher and faster adoption of hydrogen fuel cell trucks.
  - Balanced adoption: Tests adoption driven by information about decisions fleets have made in the past about what types of zero-emission trucks to purchase, as well as the likely total cost of ownership parity with combustion engines (based on industry insights and a study from the McKinsey Center for Future Mobility, called, "Why the Economics of Electrification Make This Decarbonization Transition Different)," and the resulting powertrain choice by vehicle class and primary trip type, given expected commodity growth resulting trip types.
- Characteristics of battery electric charging stations, such as the number of public versus private stations, charging efficiency, capacity factors, and utilization (assumptions around these characteristics are held constant across all three scenarios).
- Characteristics of hydrogen fuel stations, such as the split of public versus private ownership, annual fuel capacity per station, and utilization (assumptions are held constant across all three scenarios).

- Maximum distance between charging stations and hydrogen fuel stations to form an initial viable network (assumptions are held constant across all three scenarios but differ based on the rate and mix of zero-emission truck power train adoption included in each scenario).

Exhibits 2 and 3 illustrate the overall approach for modelling energy demand for zero-emission truck charging and fueling and the resulting infrastructure necessary.

Exhibit 2. Approach for Estimating Energy Required

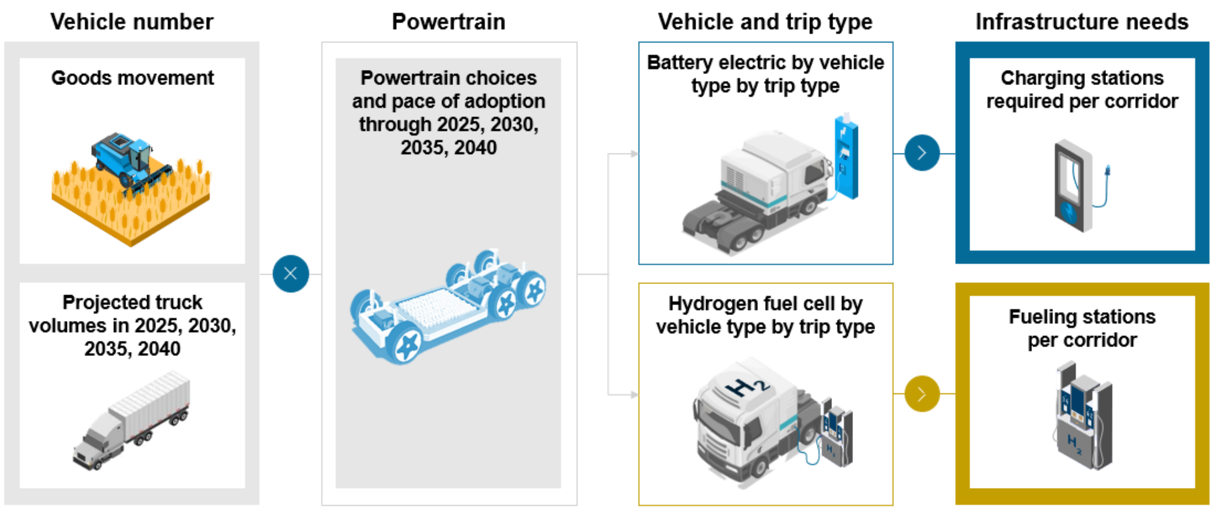


Exhibit 3. Detailed Infrastructure Modeling Logic

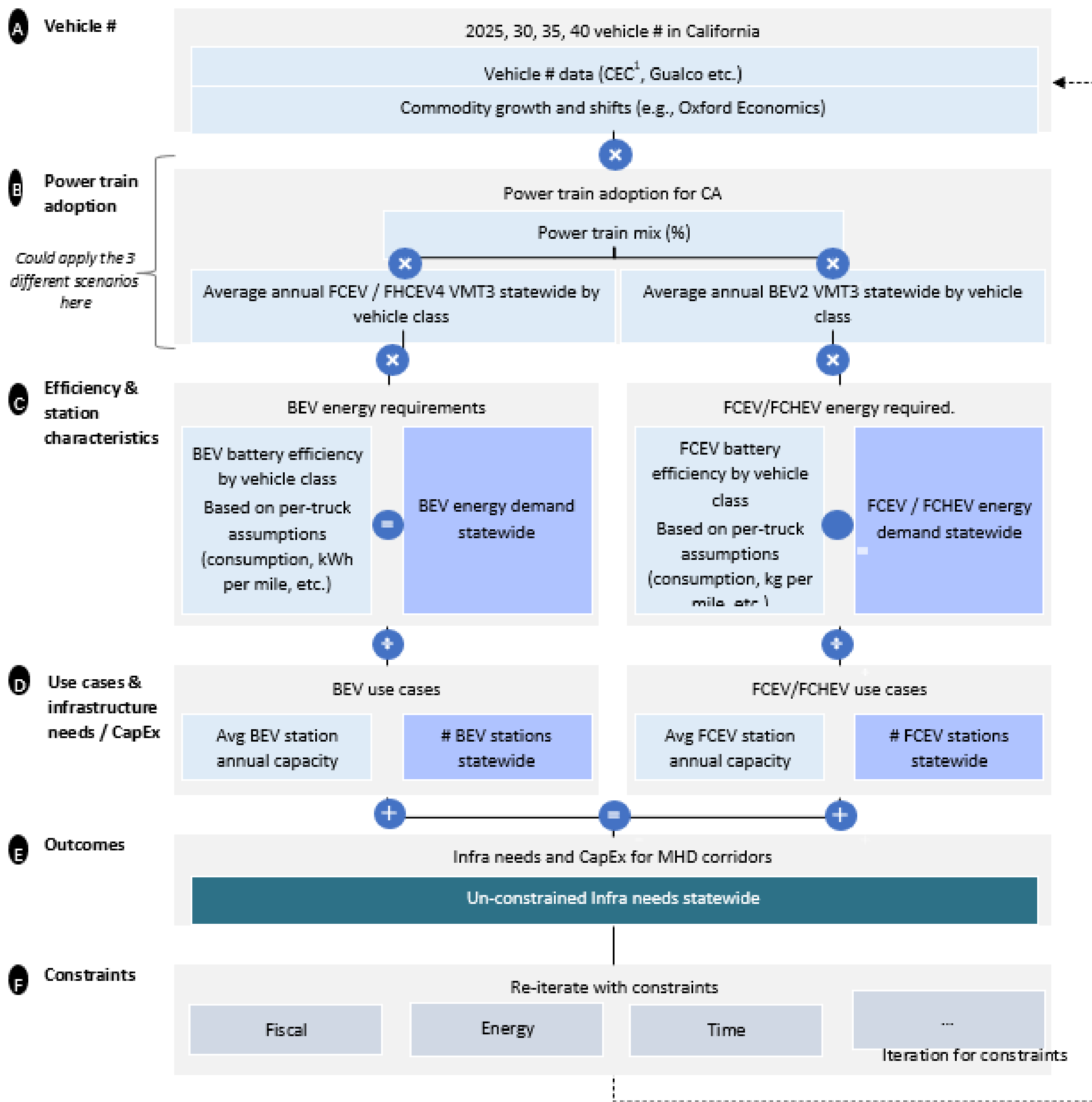
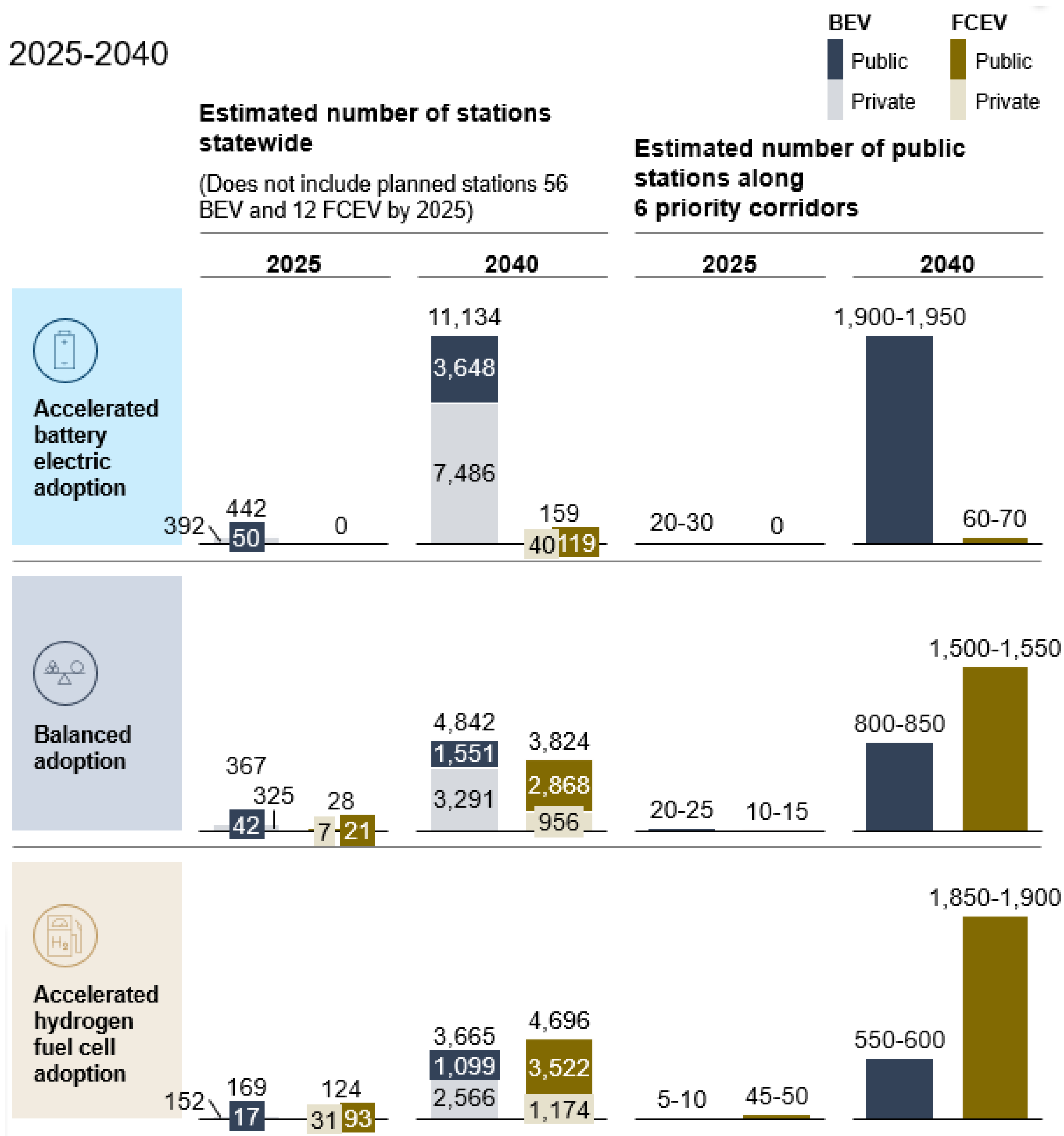


Exhibit 4 below shows the estimated stations needed in 2025 and 2040.



The remaining two exhibits show the number of estimated stations needed in each of the four study years, both statewide and along the top 6 freight corridors.

Exhibit 5. Estimated Statewide Stations Needed Under the 3 Scenarios

Accelerated BEV

	# BEV stations required			
Station Type	**2025**	**2030**	**2035**	**2040**
BEV Private	392	2,561	5,533	7,486
BEV Public	50	723	2,082	3,648
Total	**442**	**3,284**	**7,615**	**11,133**

	# HRS stations required			
Charger Type	**2025**	**2030**	**2035**	**2040**
FCEV Private	0	0	1	40
FCEV Public	0	0	3	119
Total	**0**	**0**	**4**	**159**

Accelerated FCEV

	# BEV stations required			
Station Type	**2025**	**2030**	**2035**	**2040**
BEV Private	152	883	1,910	2,566
BEV Public	17	222	630	1,099
Total	**168**	**1105**	**2540**	**3665**

	# HRS stations required			
Charger Type	**2025**	**2030**	**2035**	**2040**
FCEV Private	31	280	717	1,174
FCEV Public	93	840	2,150	3,522
Total	**124**	**1,120**	**2,866**	**4,696**

Balanced

	# BEV stations required			
Station Type	**2025**	**2030**	**2035**	**2040**
BEV Private	325	1,605	2,661	3,291
BEV Public	42	450	970	1,551
Total	**367**	**2055**	**3631**	**4841**

	# HRS stations required			
Charger Type	**2025**	**2030**	**2035**	**2040**
FCEV Private	7	150	539	956
FCEV Public	21	451	1,618	2,868
Total	**28**	**602**	**2,157**	**3,824**

Exhibit 6. Estimated Stations Needed Along the Top 6 Freight Corridors Under the 3 Scenarios

Accelerated BEV

	# BEV stations required			
Station Type	**2025**	**2030**	**2035**	**2040**
BEV Private	206	1,344	2,904	3,929
BEV Public	26	380	1,093	1,915
Total	**232**	**1,724**	**3,997**	**5,844**

	# HRS stations required			
Charger Type	**2025**	**2030**	**2035**	**2040**
FCEV Private	0	0	0	21
FCEV Public	0	0	1	63
Total	**0**	**0**	**2**	**84**

Accelerated FCEV

	# BEV stations required			
Station Type	**2025**	**2030**	**2035**	**2040**
BEV Private	80	464	1,003	1,347
BEV Public	9	116	331	577
Total	**88**	**580**	**1,333**	**1,924**

	# HRS stations required			
Charger Type	**2025**	**2030**	**2035**	**2040**
FCEV Private	16	147	376	616
FCEV Public	49	441	1,128	1,849
Total	**65**	**588**	**1,505**	**2,465**

Balanced

	# BEV stations required			
Station Type	**2025**	**2030**	**2035**	**2040**
BEV Private	171	843	1,397	1,727
BEV Public	22	236	509	814
Total	**193**	**1,079**	**1,906**	**2,541**

	# HRS stations required			
Charger Type	**2025**	**2030**	**2035**	**2040**
FCEV Private	4	79	283	502
FCEV Public	11	237	849	1,505
Total	**15**	**316**	**1,132**	**2,007**