Appendix F-2

Bus Price Projections

Bus prices have increased over time. In addition to inflation, the price increase could be a result of possible improvement and adds-on of bus specifications. This appendix explains the methodology staff used to project future bus prices for the cost analysis. Staff's projection is to acknowledge the increasing trend for bus prices. As explained below, the actual bus prices could fluctuate greatly over time.

Bus price for conventional buses increases over time, because of inflation as well possible improvement and adds-on of bus specifications. An average of 2 percent inflation rate is observed between 2005 and 2015, based on both Consumer Price Index (CPI)[1] and Producer Price Index (PPI)[2]. Above inflation, improved or new bus specification is another important factor that causes bus price increase. For example, the integration of new powerpack technology to meet more stringent emission standards could raise costs of buses with internal combustion engines[3].

Historical bus prices for 40-ft conventional bus fluctuate widely, as shown in Figure 1. The changes of bus price between neighboring years of the timeframe 2005-2015 range from -0.5 to 10.8 percent for diesel buses, and from -2.0 to 10.0 percent for CNG buses, as shown by the medians of "amount paid per vehicle" from Public Transportation Vehicle Database reported by American Public Transportation Association (APTA)[4,5]. If a simple linear regression is made between median bus price in previous year and in current year, the slope of this line could reflect the increasing rate of bus price. The annual increasing rates of bus prices for diesel, CNG, and diesel hybrid are 4.4 percent, 3.5 percent, and 2.4 percent, respectively.

[1] Bureau of Labor Statistic. Historical Consumer Price Index for All Urban Consumers (CPI-U). May, 2018. Available: https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201805.pdf.

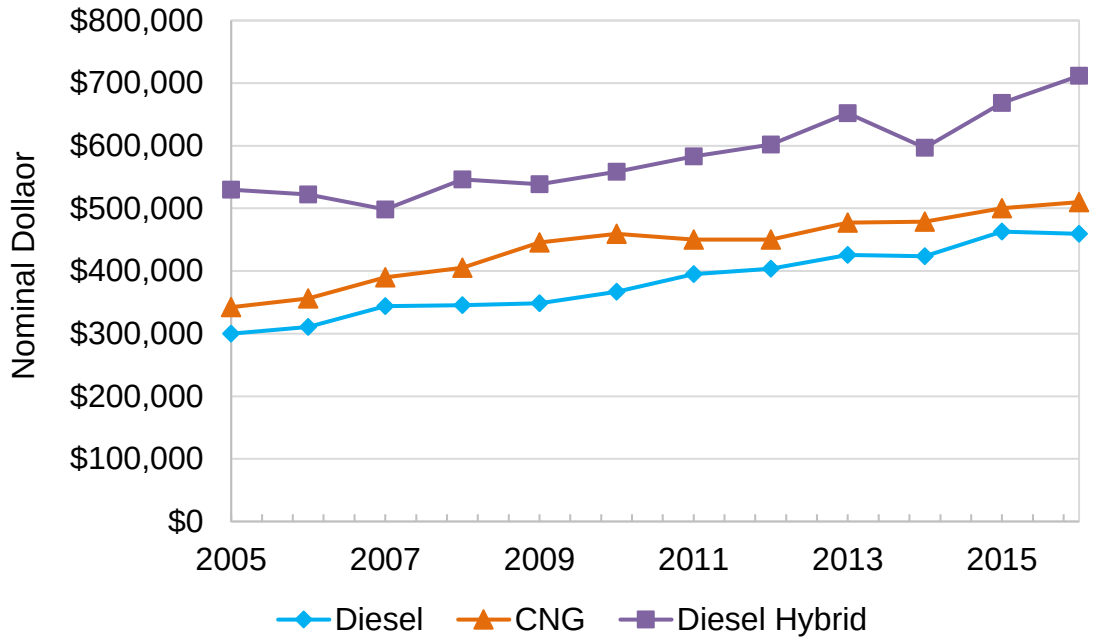
[2] Bureau of Labor Statistics (2018). Producer Price Index (PPI). Series ID: WPU1413. (PPI 2013 annual average is 226.6. PPI 2015 annual average is 235.3. PPI 2016 annual average is 237.5.) Data extracted on July 23, 2018. Available: https://data.bls.gov/cgi-bin/srgate.

[3] CE Delft (2013). An overview of state-of-the-art technologies and their potential. July, 2013. Available: http://www.theicct.org/sites/default/files/publications/CE_Delft_4841_Zero_emissions_trucks_Def.pdf.

[4] American Public Transportation Association (APTA) (2017). Public Transportation Vehicle Database.

[5] The database is an annual report of revenue vehicles by fleet characteristics, including date of manufacture, manufacturer, length, and equipment for approximately 150 U.S. transit agencies and 10 Canadian transit agencies.

Figure 1: Historical prices for 40-ft diesel, CNG, and diesel hybrid buses (2005-2015) (APTA Database)



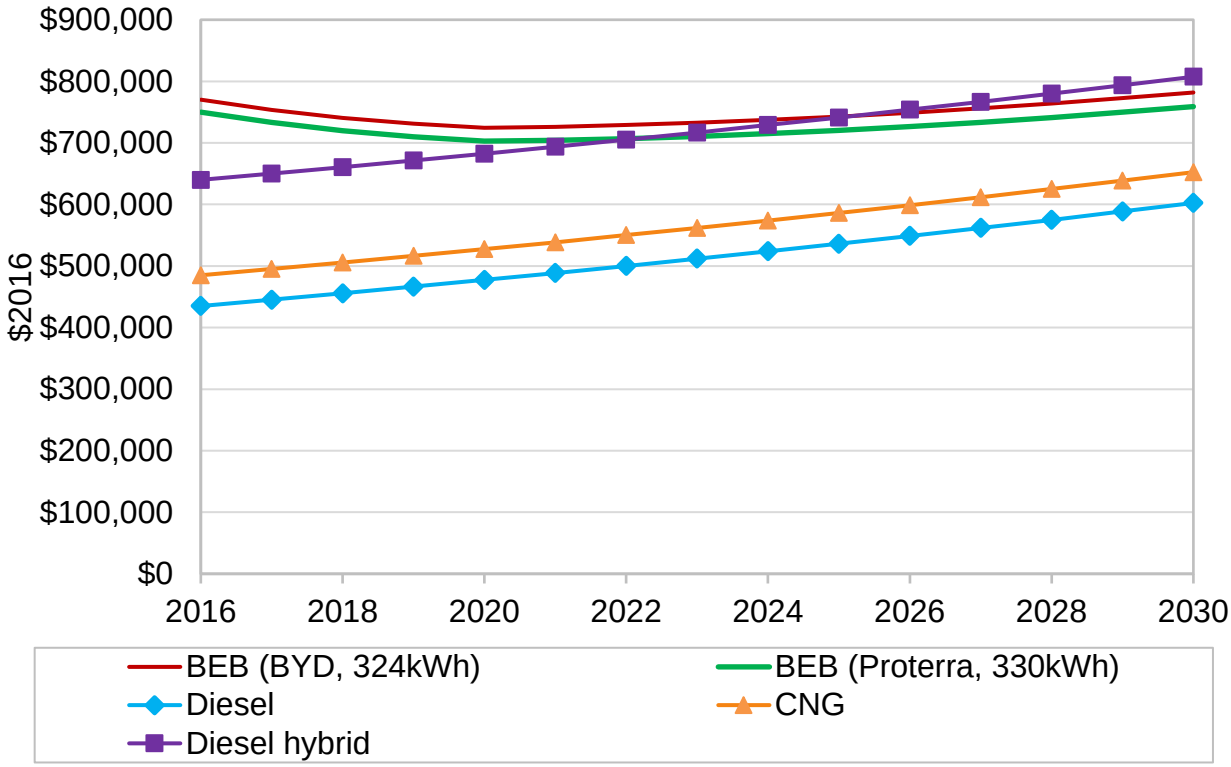
To project bus prices in the near future, CARB staff assumes that conventional bus price will follow similar increasing rates to the ones shown in the historical data. It is acknowledged that bus prices fluctuate over time, the application of one single annual increasing rate would omit these fluctuations, and future bus price could change by a rate different from historical ones. Conventional bus prices are projected in the following processors:

(1) CARB staff proposes to use $435,000 for 2016 pre-tax diesel bus price[6] (see Appendix F-1);
(2) An increasing rate of 4.4 percent per year and the diesel bus price in 2016 is used to estimate diesel bus prices in nominal dollars in the near future;
(3) The projected diesel bus prices in nominal dollars are deescalated to 2016 constant dollars by applying 2 percent inflation rate;
(4) Projections of CNG and diesel hybrid bus prices in 2016 constant dollars are estimated by adding incremental costs to diesel bus prices. The incremental costs of CNG and diesel hybrid buses over diesel ones are $50,000 and $205,000, respectively. The incremental costs stay constant over time

[6] California Air Resources Board (CARB) (2017). Bus Price Analysis. February 10, 2017. Available: https://arb.ca.gov/msprog/ict/meeting/mt170626/170626buspricesanalysis.pdf.

The price projection for battery electric buses (BEBs) is similar to projections for CNG and diesel hybrid buses, except that additional cost reductions of bus batteries need to be considered. While there is a lack of information about explicit relationships between production volume and battery cost for heavy-duty vehicle applications, CARB staff estimates that battery costs for buses will decrease over time and they are $725/kWh in 2015, $405/kWh in 2020, and $218/kWh in 2030 for batteries used in depot-charging buses, as shown in Figure 4 of staff's discussion document about battery costs (Appendix E)[7]. To calculate BEB prices in 2016 constant dollars, these battery unit costs are deescalated by using 2 percent inflation rate and the values in years between are estimates by using exponential interpolation. Finally, BEB price is estimated by adding incremental cost to projected diesel bus price and deducting cost reduction from batteries. Bus price projections for both conventional and BEBs are shown in Figure 2.

Figure 2: Bus price projections for conventional buses and BEBs.



[7] California Air Resources Board (CARB) (2017). Battery Cost for Heavy-Duty Electric Vehicles. August, 14, 2017. Available: https://www.arb.ca.gov/msprog/bus/battery_cost.pdf.

References

The following documents are the technical, theoretical, or empirical studies, reports, or similar documents relied upon in proposing these regulatory amendments, identified as required by Government Code, section 11346.2, subdivision (b)(3). Additionally, each appendix References the documents upon which it relies, as required by Government Code, section 11346.2, subdivision (b)(3).

Note: Each "Explanatory Footnote" is a footnote containing explanatory discussion rather than referencing specific documents relied upon.

1. Bureau of Labor Statistic. Historical Consumer Price Index for All Urban Consumers (CPI-U). May, 2018. Available: https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201805.pdf.

2. Bureau of Labor Statistics. Producer Price Index (PPI), Series ID: WPU1413. Available: https://data.bls.gov/cgi-bin/srgate

3. CE Delft (2013). An overview of state-of-the-art technologies and their potential. July, 2013. Available: http://www.theicct.org/sites/default/files/publications/CE_Delft_4841_Zero_emissions_trucks_Def.pdf.

4. American Public Transportation Association (APTA) (2017). Public Transportation Vehicle Database

5. Explanatory Footnote

6. California Air Resources Board (CARB) (2017). Bus Price Analysis. February 10, 2017. Available: https://arb.ca.gov/msprog/ict/meeting/mt170626/170626buspricesanalysis.pdf..

7. California Air Resources Board (CARB) (2017). Battery Cost for Heavy-Duty Electric Vehicles. August 14, 2017. Available: https://www.arb.ca.gov/msprog/bus/battery_cost.pdf.