Methodology for estimating emission and petroleum reductions

Vehicles / Equipment:

Where possible, fuel logs of equipment being replaced were used to determine the petroleum reductions and the 2017 Carl Moyer Program cost-effectiveness methodology and emission tables[1] were used to determine emission reductions. Emission factors for equipment not included in the Carl Moyer Program emission tables were estimated using the California Air Resources Board's EMFAC model[2]

Formula C-5: Estimated annual emissions based on mileage (tons/yr)

Annual emissions by pollutant (tons/yr) =
(emission factor (g/mi) + deterioration product (g/mi) (if applicable)) * annual activity (mi/yr) * percentage operation in eligible area / 907,200 (g/ton)

Mile-based deterioration product (g/mi) =
deterioration rate (g/mi-10,000 mi) * total equipment activity (mi)

Total equipment activity(b) (mi) =
annual activity (mi/yr) * deterioration life (yrs)

Deterioration life (baseline equipment) (yrs) =
expected first year of operation – baseline engine model year + (project life / 2) Deterioration life (reduced equipment) (yrs) = project life / 2

(b) Total equipment activity for mile-based calculations is limited to 400,000 miles for school buses or 800,000 miles for other on-road vehicles. Used heavy heavy-duty replacement vehicles add 500,000 miles, medium heavy-duty vehicles add 250,000 miles, or light heavy-duty vehicles add 150,000 miles.

Formula C-6: Estimated annual emissions based on hours of operation (tons/yr)

Annual emissions by pollutant (tons/yr) =
(emission factor (g/bhp-hr) + deterioration product (g/bhp-hr) (if applicable)) * horsepower (hp) * load factor * annual activity (hrs/yr) * percentage operation in eligible area / 907,200 (g/ton)

Hour-based deterioration product (g/bhp-hr) =
deterioration rate (g/bhp-hr-hr) * total equipment activity (hrs)

Total equipment activity(c) (hrs) =
annual activity (hrs/yr) * deterioration life (yrs)

[1] https://ww3.arb.ca.gov/msprog/moyer/guidelines/current.htm
[2] https://arb.ca.gov/emfac/

Deterioration life (baseline equipment) (yrs) =
expected first year of operation – baseline engine model year + (project life / 2) Deterioration life (reduced equipment) (yrs) = project life / 2

(c) Total equipment activity for hour-based calculations is limited to a maximum of 12,000 hours for diesel engines, 3,500 hours for large-spark ignition (LSI) engines with a model year of 2006 or older, or 5,000 hours for LSI engines with a model year of 2007 or newer

Electric Vehicle Charging Stations

Each kWh dispensed by an electric vehicle charging station was assumed to displace 3.36 miles[3] of driving using conventionally fueled vehicles. The average fuel economy of a conventionally fueled vehicle was estimated using the California Air Resources Board's EMFAC model. Emissions were estimated using the formula C-5 above.

Estimated annual petroleum reductions (gallons/yr)

Petroleum reduced (gallons/yr) =
Electricity delivered by charging station (kWh/yr) * 3.36 (miles/kWh) / average fuel economy of a conventionally fueled vehicle (miles/gallon)

[3] Estimated number of miles an average electric vehicle could drive using 1 kWh of electricity. Determined by a weighted average of the battery capacity / the rated range of the electric vehicles on Bay Area roads as of 2013.