

APPENDIX A

Revenue Sound Bite Methodology



Revenue Sound Bite Methodology

Introduction

This report describes the methodology used to estimate of nationwide federal gas tax revenues through 2050 assuming no changes to the current federal gas tax policy for the federal gas tax revenue sound bite, formally titled “Impacts of the Growing Fuel Efficient and Electric Vehicle Market on Gas Tax Revenues in the U.S.”. That analysis focuses on gasoline tax only (no diesel tax) and therefore considers only light-duty vehicles as it is assumed that these vehicles use gasoline while heavy-duty vehicles use diesel. The Eastern Transportation Coalition used the same methodology to create revenue sound bites for both state and federal data.

The primary outcome of the revenue analysis is the comparison of potential federal gas tax revenue losses (unrealized revenue) resulting from the anticipated increase in fuel efficiency and electrification of vehicles. This memorandum summarizes the methodology applied to develop the revenue estimates and provides a list of the data sources used in the analysis.

All revenue estimates have been forecasted in nominal dollars, also known as year of expenditure dollars.

CDM Smith estimated the potential revenue yield from the federal gas tax in the country. The analysis assumes that the federal gas tax rate stays at 18.4 cents per gallon throughout the forecast horizon.

Primary Data Sources

Table 1 summarizes the primary data sources used in the analysis. Data sources available online were used, including data reported by the Federal Highway Administration (FHWA), the U.S. Energy Information Administration (EIA) and the U.S. DOE Alternative Fuel Data Center (AFDC).¹

Table 1: Primary Data Sources

Primary Data Type	Sources
Vehicle Miles Traveled (VMT)	FHWA Highway Performance Monitoring System (HPMS)
Vehicle Registrations	FHWA Highway Performance Monitoring System (HPMS)
Fuel Efficiency (Historical and forecast)	FHWA Highway Performance Monitoring System (HPMS) U.S. Energy Information Administration (EIA)
Vehicle Fleet Electrification (Historical and forecast)	U.S. Energy Information Administration (EIA)

¹ Federal Revenue Sound Bite analysis was completed in May 2024 using datasets available at that time. Subsequent administrative changes and regulatory updates may affect the accuracy of these projections.

Existing Fleet

Using the sources previously identified, CDM Smith extracted the metrics relevant for this analysis for year 2022:

- **Number of light-duty vehicles** (10,000 pounds or less) – a total of 258,545,382 light-duty vehicles were identified.
- **Average miles per gallon (MPG) ratings** – The average fuel efficiency of light-duty vehicles was estimated at 22.8 MPG in 2022.
- **Number of electric vehicles** – The fleet of electric vehicles was estimated at 2,071,677 vehicles in 2022.

Electric Vehicle Adoption Scenarios

The number of electric vehicles in operation is a critical element of the revenue analysis. Two different scenarios were considered as there is no consensus on a single EV penetration model.

Slow Adoption (EIA)

This is the EV penetration forecast at the national level derived from the US Energy Information Agency's (EIA) forecast in their 2023 Annual Energy Outlook reference case (using the table on Light-Duty Vehicle Sales by Technology Type). In this model, about 12% of light-duty vehicle sales will be electric by 2030, and 14% in 2050.

Faster Adoption (BNEF)

The faster adoption scenario is based on Bloomberg New Energy Forecasts (BNEF), a widely used industry standard. In this model, 31% of light-duty vehicle sales will be electric by 2030, and 97% in 2050. Note that the California Air Resources Board (CARB) has adopted a policy by which all new Internal Combustion Engine vehicles will end in California and other states that follow CARB regulations in 2035. This policy would lead to EV adoption rates substantially faster than BNEF's projections; these would create an even faster adoption scenario that is not presented here.

Table 2: EV Share of New Passenger Vehicle Sales

EV Share of Sales	Slow Adoption (EIA)	Faster Adoption (BNEF)
2030	12%	31%
2050	14%	97%

For each EV adoption scenarios, CDM Smith used the projected EV market shares to estimate the number of electric vehicles for the years 2023-2050. Although future trends vary widely across the two scenarios, all projections are benchmarked to actual data; so all scenarios start with the actual number of EVs in 2022 and use identical projections for 2023, 2024 and 2025 before starting to diverge. The short-term projections (2023 through 2025) are from EIA's 2023 Annual Energy Outlook reference case (using the table on Light-Duty Vehicle Sales by Technology Type).

Fuel Efficiency Improvements

Fuel efficiency trends were derived from EIA's MPG forecast, as reported in their 2023 Annual Energy Outlook (using the table on Transportation Sector Key Indicators and Delivered Energy Consumption). The projection was adjusted to match the 2022 average MPG reported in FHWA's Highway Performance Monitoring System (22.8 MPG).

Future Vehicle Miles Traveled

Distance traveled by light-duty vehicles, measured in VMT (vehicle miles traveled), is another important element of the analysis. Gas tax revenue forecasts are dependent on VMT forecasts; more specifically the analysis relies on an annual forecast of VMT generated by light-duty non-electric vehicles (those that are paying the gasoline tax).

These VMT forecasts were obtained by multiplying the projected number of vehicles by the average number of miles driven per year.

Number of Vehicles

To estimate the future number of light-duty vehicles, CDM Smith followed the following steps:

- Start with the current number of light-duty vehicles (electric and non-electric) derived from FHWA's Highway Performance Monitoring System (see section on Existing Fleet)
- Apply an annual vehicle fleet growth rate of 0.6 percent (consistent with the 2010-2022 average annual population growth as reported in Census data)
- Apply a scrappage rate (i.e., turnover of existing vehicle fleet) of 4 percent annually (consistent with the national average)
- Derive the number of future EVs from the EV market share projections coming from the two EV adoption scenarios (see section on EV Adoption Scenarios).

Average Miles Driven

The average annual miles driven by light-duty vehicles was estimated at 11,502 miles per year based on FHWA's HPMS data for the period 2015-2019.

Despite an increase in Vehicle Miles Traveled (VMT) projections due to a slight increase in total vehicle registrations, the average number of miles driven per vehicle is assumed to remain constant based on historical trends. According to data from the Federal Highway Administration (FHWA), the average miles driven by light-duty vehicles in the United States has remained relatively steady, fluctuating between 11,124 and 11,520 miles per year from 2008 to 2019. Hence, the average number of miles driven per year was assumed to remain constant and to be the same for electric and non-electric vehicles.

Federal Gasoline Tax Revenue Estimates

The main purpose of this analysis is to estimate federal gas tax revenues under various scenarios and evaluate the losses (unrealized revenue) due to two factors: increased fuel efficiency and vehicle fleet electrification. The analysis assumes that the federal gas tax rate stays at 18.4 cents per gallon throughout the forecast horizon.

The report shows the full stream of annual revenue and highlights values at the years 2030 and 2050 as well as cumulative values for the period 2023 through 2050.

Gasoline tax revenues (in \$) are calculated as annual estimates of gasoline consumption (in gallons) multiplied by the gas tax rate (in dollars per gallon).

Estimates of gasoline consumption are calculated as annual VMT from non-EVs (in vehicle miles) divided by the average vehicle efficiency (in miles per gallon).

Projected Gas Tax Revenue

Annual gas tax revenues are estimated for years 2023 through 2050. These projected gas tax revenues capture the effect of future trends in MPG improvements and vehicle fleet electrification.

Revenue Loss due to MPG Improvements

Revenue losses attributed to MPG improvements are estimated by comparing fuel consumption volumes with a hypothetical scenario where the average fuel consumption would be frozen at the 2023 level (23.2 MPG).

Revenue Loss due to Fleet Electrification

Similarly, revenue losses attributed to fleet electrification are estimated by comparing fuel consumption volumes with a hypothetical scenario where the VMT from electric vehicles would be frozen at the 2023 level.

Baseline Scenario

The Baseline Scenario refers to a hypothetical scenario where both the average fuel efficiency and the number of electric vehicles would be frozen at the 2023 levels. The difference between projected revenues and Baseline revenues represents the combined losses (unrealized revenue) due to MPG improvements and fleet electrification.

Table 3 summarizes the revenues that could be expected nationwide from the federal gasoline tax.

Table 3: Federal Gas Tax Revenue Estimates (in Billions)

Federal Gas Tax	2030	2050	Cumulative 2023-2050
Slow Adoption (EIA)	\$ 20.7	\$ 16.2	\$ 531.8
Faster Adoption (BNEF)	\$ 20.1	\$ 6.0	\$ 434.1