

# HIGHWAY REVENUE ASSESSMENT TOOL USER GUIDE

A tool designed to assess the effects of various factors on state  
highway user revenue

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 **ATLAS**  
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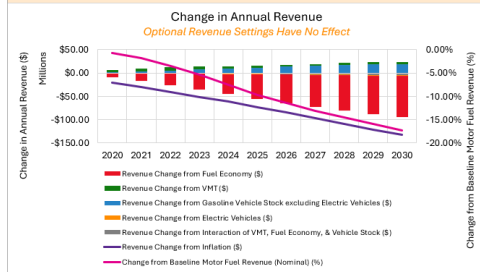
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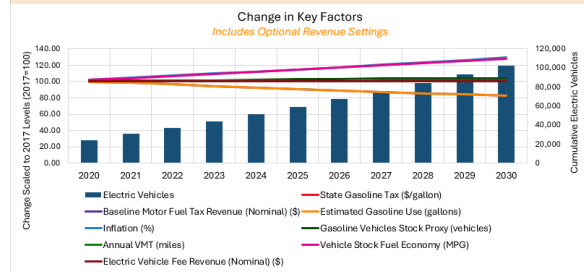
# About the Highway Revenue Assessment Tool

The Highway Revenue Assessment Tool gives users insights into how the road network is funded by motor fuel taxes and how that revenue will change with new market conditions. The tool also allows users to explore scenarios to adjust motor fuel taxes and fees on hybrid and electric vehicles to address revenue shortfalls. All highway revenue data is state-based and from the Federal Highway Administration’s Highway Statistics Series.<sup>1</sup> All projections for changes in the market, including inflation, vehicle stock, fuel economy, and vehicle miles traveled are from the U.S. Energy Information Administration’s (EIA) Annual Energy Outlook.<sup>2</sup> Users can easily customize assumptions derived from these sources to conduct tailored analyses that may better reflect real-world conditions.

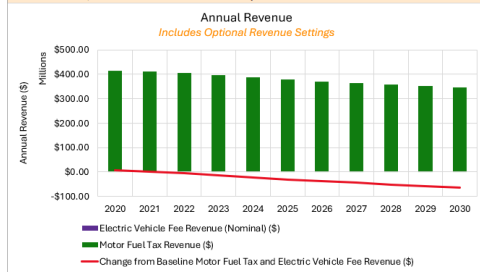
This graph estimates revenue losses compared to the baseline (first year) from several factors (negative losses are revenue increases); this graph is not affected by changes to Optional Revenue Settings. That is, this graph is intended to model business as usual if no revenue changes are made (i.e., the gasoline tax stays constant and no electric vehicle fees are added).



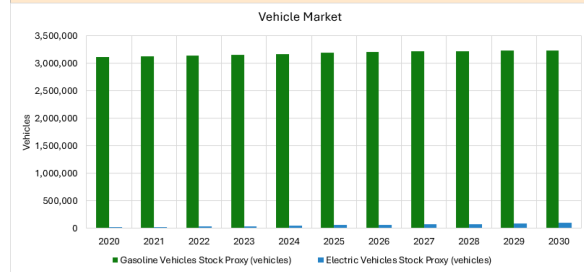
This graph shows the changes in a number of factors scaled to 2019 levels allowing for an apple-to-apples comparison of factors with different units of measurement.



This graph shows total revenue and revenue losses/gains considering all inputs, including Optional Revenue Settings. When an EV fee is selected, the revenue shown will be broken down by fuel tax revenue and EV fee revenue.



This graph shows the deployment of electric and conventional vehicles over time.



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<sup>1</sup> See <https://www.fhwa.dot.gov/policyinformation/statistics.cfm>



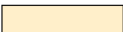
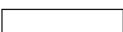
<sup>2</sup> See <https://www.eia.gov/outlooks/aeo>

# Overview of the Tool Structure

The Highway Revenue Analysis Tool was built using Microsoft Excel and is contained in a standalone Excel workbook. It is divided into two functional areas, as follows:

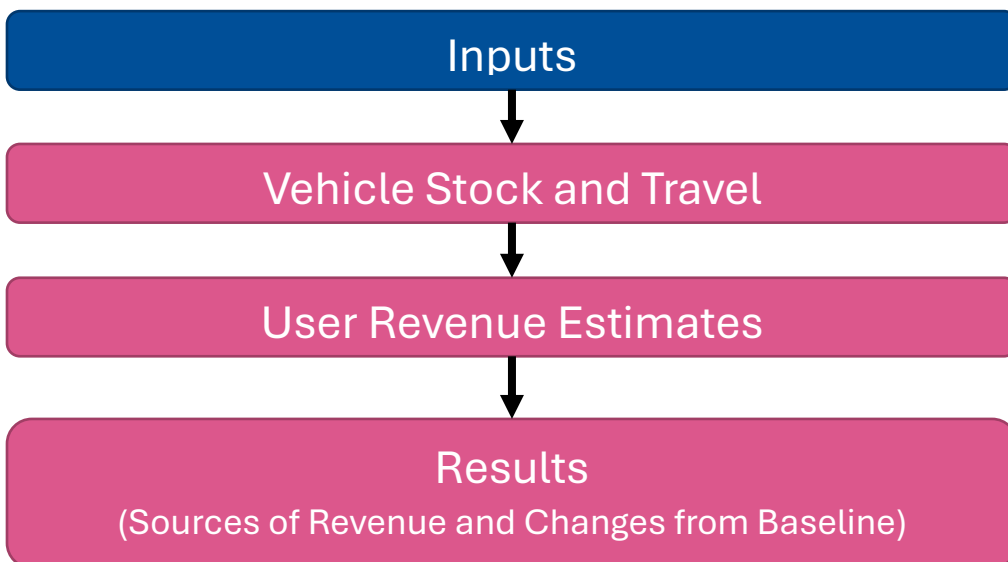
- **Tool** (Blue Tab)
- **Calculations** (Orange Tab)
- **Custom Scenarios** (Purple Tab)

User inputs in the *Tool* section are color-coded as follows:

-  User-entered inputs
-  Default assumptions that can be overwritten by user
-  Default custom scenario that can be overwritten by user
-  Calculations or assumptions that cannot be altered

Information flows from the *Inputs* section, through the *Vehicle Stock and Travel* model, and then through the *User Revenue Estimates* model, to the *Results* (Sources of Revenue and Changes from Baseline), as shown in the diagram on the Instructions tab in the tool and presented below

Figure 1: Structure of the Highway Revenue Assessment Tool



# Getting Started

## Opening the Tool

To open the tool, double click on the file “Highway\_Revenue\_Assessment\_Tool\_vX-X.xlsm” where X-X is the version of the tool. Make sure to enable macros by clicking the “Enable Content” button that appears in the yellow bar at the top of the screen.

## Model inputs

Upon opening the “Tool” tab, you will find a section labeled ‘Input’. In this section, you will create a scenario by modifying the required and optional input settings. The inputs to the model are broken down into three main sections: *Required Input*, *Optional Market and Vehicle Settings*, and *Optional Revenue Settings*.

### Required Input

In the ‘Required Input’ section shown below, you can select fields to determine what state or scenario to analyze over a set period. You can start by entering the state, and then proceed to select a vehicle type, scenario, and inflation index. Once those fields are specified, you will be able to select and baseline and end year for your analysis. A description of each possible option is available in the Appendix of this guide.

<b>State</b>	U.S. Total
<b>Vehicle Type</b>	Light-Duty Vehicles
<b>Scenario from U.S. EIA Annual Energy Outlook</b>	Reference case
<b>Inflation Index</b>	CPI
<b>End Year for Analysis</b>	2033
<b>Baseline Year for Analysis</b>	2022

### Optional Market and Vehicle settings

In the ‘Optional Market and Vehicle Settings’ section shown below, you can modify several factors to customize the analysis on fuel use and other market factors, like inflation. Note that changing the number of EVs or hybrid vehicles will change the number of gasoline vehicles, since the model assumes the absolute number of vehicles is the same as the default settings. A description of each possible option is available in the Appendix of this guide.

<b>Annual Inflation Rate (%)</b>	2.01%
<b>Share of Motor Fuel Tax Revenue from Gasoline Tax (%)</b>	69.89%
<b>Baseline Battery Electric Vehicles</b>	2,494,175
<b>Baseline Plug-in 20 Gasoline Hybrid Vehicles</b>	748,972
<b>Baseline Plug-in 50 Gasoline Hybrid Vehicles</b>	363,337
<b>Baseline Hybrid Electric Vehicles</b>	6,920,738
<b>Annual Battery Electric Vehicle Growth Rate (%)</b>	18.66%
<b>Annual Plug-in 20 Gasoline Hybrid Vehicle Growth Rate (%)</b>	13.75%
<b>Annual Plug-in 50 Gasoline Hybrid Vehicle Growth Rate (%)</b>	10.17%
<b>Annual Hybrid Electric Vehicle Growth Rate (%)</b>	6.52%
<b>Plug-in 20 Gasoline Hybrid Share of Electric Miles (%)</b>	23.00%
<b>Plug-in 50 Gasoline Hybrid Share of Electric Miles (%)</b>	63.00%
<b>Annual Change in Vehicle Stock Fuel Economy (MPG) (%)</b>	1.20%
<b>Annual Change in VMT (%)</b>	0.31%

### Optional Revenue Settings

In the ‘Optional Revenue Settings’ section shown below, you can explore ways to change how revenue is collected, such as how the state gasoline tax is set. A description of each possible option is available in the Appendix of this guide.

<b>Baseline Gasoline Tax (\$/gallon)</b>	\$0.184
<b>Baseline Diesel Tax (\$/gallon)</b>	\$0.244
<b>Fuel Economy of Vehicle that EV is Replacing (MPG)</b>	26.49
<b>Index Motor Fuel Tax to Inflation (Yes/No)</b>	No
<b>Index Motor Fuel Tax to Fuel Use (Yes/No)</b>	No

You can reset all optional settings to their default values by pressing the “Reset Optional Settings to Default” button. Note that by doing so, you will not be able to recover any unsaved settings you have previously entered.

### Custom Scenarios

By default, the tool includes vehicle stock scenarios from the U.S. EIA’s Annual Energy Outlook. This includes the number of conventional and alternative fuel vehicles by vehicle type (passenger car or light truck) and year. In addition, the scenarios include estimates over time for vehicle miles traveled and for inflation. The ‘Custom Scenarios’ tab lets you customize these values. Press the “Reset Custom Scenarios to Default” to reset your custom scenario to the tool’s default value. Any changes you’ve made will be lost.

## Tool Results

Once your inputs have been made, you can scroll to the “Tool Results” of the ‘Tool’ tab to explore the results of the model through descriptive summary statistics, as well as graphical representations of the forecasts resulting from the model.

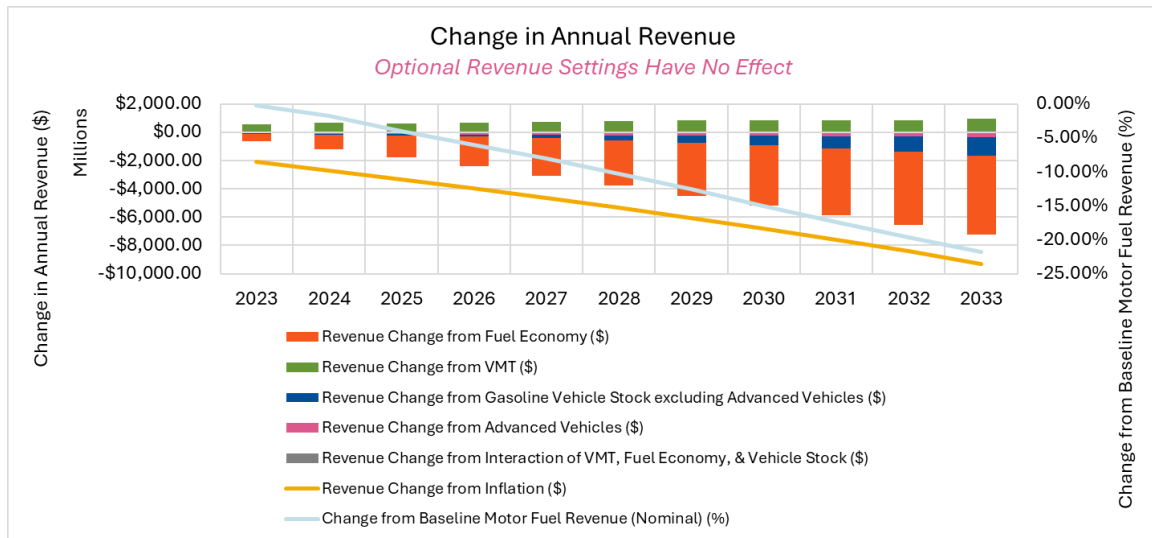
### Summary Statistics

The results of the model are available in a section of summary statistics, where you can view results such as the baseline revenue, revenue breakdown, revenue mechanisms, and vehicle market, travel, and fuel use. These absolute numbers for the first and last years from the model are shown as well as the total change and percentage change. More detailed results are available in the *Calculations* tab.

	2023	2033		
<b>Baseline Revenue (Motor Fuel Tax only) does not include any Optional Settings</b>				
Baseline Motor Fuel Tax Revenue (Nominal), 2023-2033 (\$)	\$28,791,634,485	\$22,565,750,213		
<b>Revenue Breakdown (Motor Fuel Tax and Advanced Vehicle Fees) considering Optional Settings</b>				
Motor Fuel Tax Revenue (\$)	\$29,564,469,716	\$23,100,516,368		
Advanced Vehicle Fee Revenue (Nominal) (\$)	\$0	\$0		
<b>Revenue Mechanisms</b>				
Gasoline Tax (\$/gallon)	\$0.18	\$0.18		
Fixed Battery Electric Vehicle Fee (Nominal) (\$/vehicle)	\$0.00	\$0.00		
Fixed Plug-In Hybrid Electric Vehicle Fee (Nominal) (\$/vehicle)	\$0.00	\$0.00		
Fixed Hybrid Electric Vehicle Fee (Nominal) (\$/vehicle)	\$0.00	\$0.00		
<b>Vehicle Market, Travel, and Fuel Use</b>				
Inflation	2.68%	2.37%		
Gasoline Consumption (gallons)	156,476,274,376	122,639,946,808		
Gasoline Vehicle Stock (vehicles)	301,823,707	285,465,363		
Gasoline Vehicle Stock Fuel Economy (MPG)	24.2	29.4		
Electric Vehicle Stock (vehicles)	4,731,106	25,040,899		
Advanced Vehicle Stock (vehicles)	12,103,217	38,908,030		
Annual VMT (miles)	12,526	12,641		
			<b>Total Change</b>	<b>Absolute Change in %</b>
				<b>Average Annual Change in %</b>
Change in Baseline Motor Fuel Tax Revenue (Nominal), 2023-2033 (\$), (%)			-\$6,225,884,273	-22%
				-2.26%
Change in Motor Fuel Tax Revenue, 2023-2033 (\$), (%)			-\$6,463,953,348	-22%
Change in Electric Vehicle Fee Revenue (Nominal), 2023-2033 (\$), (%)			\$0	0%
				0.00%
Change in Gasoline Tax, 2023-2033 (\$), (%)			\$0.00	0.0%
Change in Annual Battery Electric Vehicle Fee (Nominal), 2023-2033 (\$), (%)			\$0.00	0.0%
Change in Annual Plug-In Hybrid Electric Vehicle Fee (Nominal), 2023-2033 (\$), (%)			\$0.00	0.0%
Change in Annual Hybrid Electric Vehicle Fee (Nominal), 2023-2033 (\$), (%)			\$0.00	0.0%
				0.00%
Change in Inflation, 2023-2033 (%)			-0.31%	-12%
Change in Gasoline Consumption, 2023-2033 (gallons), (%)			-33,836,327,569	-22%
Change in Gasoline Vehicle Stock, 2023-2033 (vehicles), (%)			-16,358,344	-5%
Change in Vehicle Fuel Economy, 2023-2033 (MPG), (%)			5	22%
				1.93%
Change in Advanced Vehicle Stock, 2023-2033 (vehicles), (%)			20,309,793	429%
				16.04%
Change in Advanced Vehicle Stock, 2023-2033 (vehicles), (%)			26,804,813	221%
				11.19%
Change in Annual VMT, 2023-2033 (miles), (%)			115	0.92%
				0.25%

## Change in Annual Revenue Graph

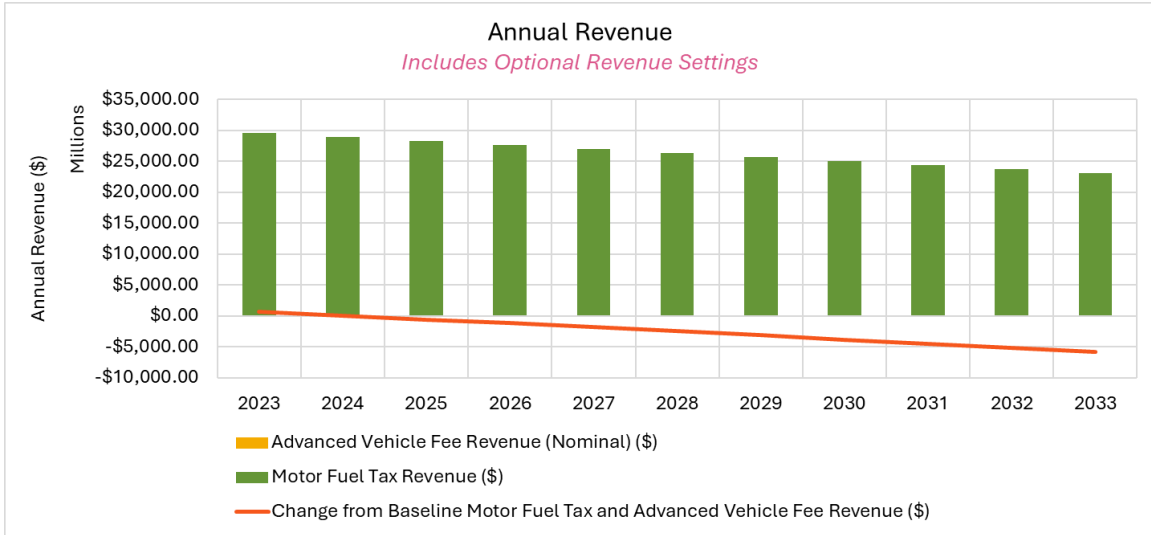
This graph (pictured below) estimates revenue losses compared to the baseline (first year) from several factors (negative losses are revenue increases); this graph is not affected by changes to Optional Revenue Settings. That is, this graph is intended to model business as usual if no revenue changes are made (i.e., the gasoline tax stays constant and no electric or hybrid vehicle fees are implemented).



## Annual Revenue Graph

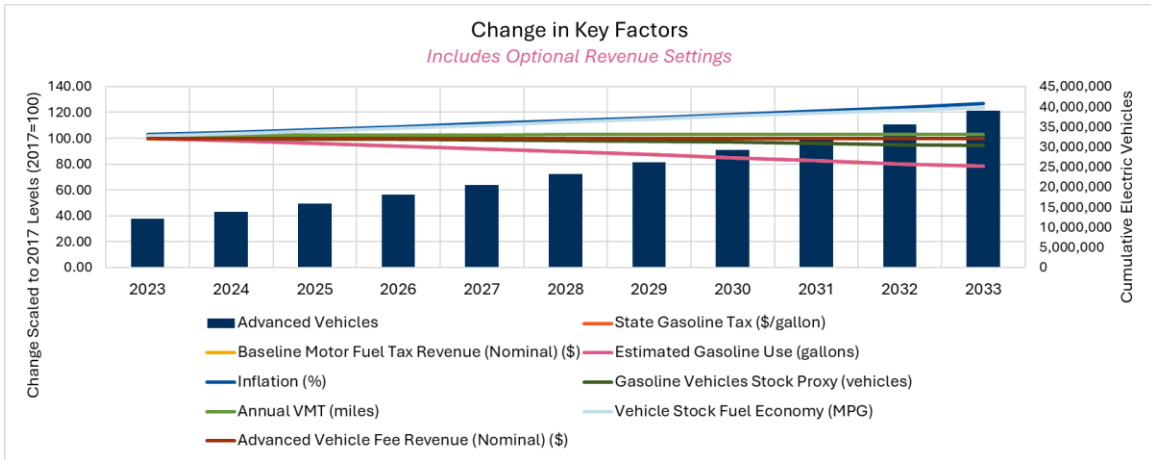
This graph (pictured below) shows total revenue and revenue losses/gains considering all inputs, including Optional Revenue Settings. When an EV or hybrid vehicle fee is selected, the revenue shown will be broken down by fuel tax revenue and EV and/or or hybrid vehicle fee revenue.





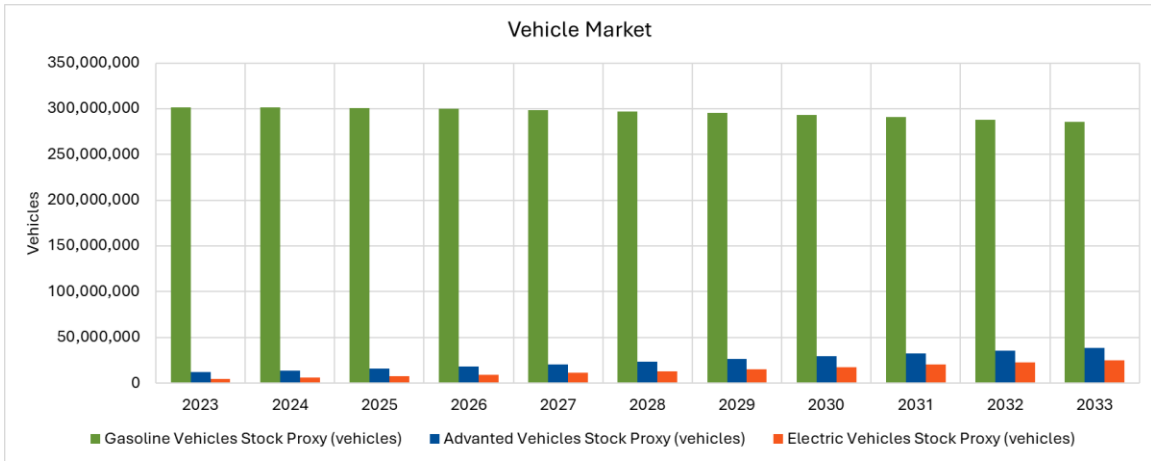
### Graph of change in key factors

This graph (pictured below) shows the changes in a number of factors scaled to the baseline year levels allowing for an apple-to-apples comparison of factors with different units of measurement.



### Graph of Vehicle Market

This graph (pictured below) shows the electric and gasoline vehicles deployed over time.



## Calculations

In the calculations tab, you will find detailed tables that serve as the main calculations behind the model. Below, you will find a summary of each section, along with the significance each section has regarding the model.

### Model Input

The ‘Vehicle Stock’ table provides the basis for current and projected future stock of passenger cars and lights trucks in the country. This data is divided further to show the differences in stock between vehicles of varying technology types. This unit for this table is 1 = 1 million vehicles. This table is derived directly from data made available by the U.S. EIA or the custom scenario input.

The ‘Vehicle Stock MPG’ table provides the basis for current and projected future MPG of passenger cars and lights trucks in the country. This data is divided further to show the differences in MPG between vehicles of varying technology types. This table is derived directly from data made available by the U.S. EIA or the custom scenario input.

The ‘Inflation Options’ table provides the basis for current and projected future inflations rates for three different indexes. A detailed explanation of each of these indexes are available in the appendix. This table is derived directly from data made available by the U.S. EIA or custom scenario input.

### Model Output

In the ‘Market and Vehicle Forecast’ section, you will find several forecasted factors that are used in the model’s revenue calculations. Note that these numbers are estimates and are intended to provide insights into possible future changes in factors such as vehicle stock,

gasoline use, and average fuel economy. A detailed explanation of these calculations can be found in Appendix B of this user guide.

In the 'Highway Revenue Projections' section, you can view how the revenue changes each year from the base year. This section is divided into three parts, to account for different ways to estimate revenue. Note that all the 'change' formulas represent the total change from the current year to the base year, and year-over-year changes are not included in any calculations in this section.

In the 'Baseline Motor Fuel Tax Revenue' part, you can view the nominal projected revenue each year, along with the total change in revenue from the base year. These calculations do not include any revenue accrued from electric or hybrid vehicle fees, as well as any adjustments from inflation. These fields are meant to serve as a baseline comparison against the next section, to show factors like inflation and fees can affect revenue.

In the 'Motor Fuel Tax and Advanced Vehicle Fee Revenue' part, you can view the annual adjusted projected revenue and the total change from the base year, along with the breakdown of the revenue sources. Note these calculations include revenue accrued from electric and hybrid vehicle fees, as well as adjustments from inflation.

In the 'Revenue Changes from Individual Factors' part, you can explore how changes in a single factor contribute to the total change in revenue. The projections in this section represent how allowing one factor to change over time will change the estimated revenue, while all other factors remain held at the baseline year.

In the 'Motor Fuel Tax and Advanced Vehicle Fee Revenue Levels' section, you can view the projected change in the estimated state gasoline tax, as well as revenue accrued from electric vehicle fees and their components. Note that gasoline tax will only change over time if the user selects 'Yes' to either the 'Index Motor Fuel Tax to Inflation' option or the 'Index Motor Fuel Tax to Fuel Use' option in the 'Optional Revenue Settings' section.

A detailed explanation of these calculations can be found in Appendix B of this user guide.

In the 'Factors Indexed to Baseline Year Levels' section, you can view how a number of factors change indexed to the baseline year.

# Appendix A: Input Fields Descriptions

This appendix describes each user input field. The Highway Revenue Assessment Tool has four categories of inputs: 'Required Inputs', 'Optional Market and Vehicle Settings' and 'Optional Revenue Settings'.

## Required Inputs

Input Field	Description
<b>State</b>	Select a state or U.S. Total for nationwide averages.
<b>Vehicle Type</b>	Motor Vehicle registrations are reported by major vehicle classes: automobiles, buses, trucks, and motorcycles. The truck category includes light trucks to the extent they can be identified and separated from automobiles. The light truck category includes pickups, vans (full-size and mini), utility-type vehicles, as well as other vehicles (panel trucks and delivery vans generally of 10,000 pounds or less gross vehicle weight).
<b>Scenario from U.S. EIA Annual Energy Outlook</b>	Scenario from the U.S. Energy Information Administration Annual Energy Outlook or a custom scenario.
<b>Inflation Index</b>	<p><b>Consumer Price Index (CPI):</b> A measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food, and medical care. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them.<sup>3</sup></p> <p><b>Producer Price Index (PPI):</b> A group of indexes that calculates and represents the average movement in selling prices from domestic production over time. PPI is a product of the Bureau of Labor Statistics (BLS). The PPI measures price movements from the seller's point of view.<sup>4</sup></p>

<sup>3</sup> <https://www.investopedia.com/terms/c/consumerpriceindex.asp>

<sup>4</sup> <https://www.investopedia.com/terms/p/ppi.asp>

Input Field	Description
	<b>National Highway Construction Cost Index (NHCCI):</b> A quarterly price index intended to measure the average changes in the prices of highway construction costs over time and to convert current-dollar highway construction expenditures to real dollar expenditures. <sup>5</sup>
<b>End Year for Analysis</b>	Last year for the analysis. This can help with exploring short-term versus long-term trends. This only affects the output calculations. The default settings that a user can overwrite are based on data through 2050.
<b>Baseline Year for Analysis</b>	First year of analysis. This is currently not configurable.

## Optional Market and Vehicle Settings

Input Field	Description
<b>Annual Inflation Rate (%)</b>	The default is the average forecast inflation rate. Overriding this sets a constant inflation rate for all years.
<b>Share of Highway-User Revenue (%)</b>	The share of highway user revenue used for roads. Calculated from state data and used as a baseline for revenue changes forecast.
<b>Baseline Battery Electric Vehicles</b>	The number of BEVs in the first year. The default value is based on national data.
<b>Baseline Plug-in 20 Gasoline Hybrid Vehicles</b>	The number of PHEVs that can travel 20 miles on electricity in the first year. The default value is based on national data.
<b>Baseline Plug-in 50 Gasoline Hybrid Vehicles</b>	The number of PHEVs that can travel 50 miles on electricity in the first year. The default value is based on national data.
<b>Baseline Hybrid Electric Vehicles</b>	The number of hybrid vehicles in the first year. The default value is based on national data.

<sup>5</sup> <https://www.fhwa.dot.gov/policy/otps/nhcci/desc.cfm>

Input Field	Description
<b>Annual Battery Electric Vehicle Growth Rate (%)</b>	The default is average annual growth rate of battery electric vehicles. Overwrite this value to customize the growth rate.
<b>Annual Plug-in 20 Gasoline Hybrid Vehicle Growth Rate (%)</b>	The default is average annual growth rate of plug-in hybrid electric vehicles with 20 miles of electric range. Overwrite this value to customize the growth rate.
<b>Annual Plug-in 50 Gasoline Hybrid Vehicle Growth Rate (%)</b>	The default is average annual growth rate of plug-in hybrid electric vehicles with 50 miles of electric range. Overwrite this value to customize the growth rate.
<b>Annual Hybrid Electric Vehicle Growth Rate (%)</b>	The default is average annual growth rate of hybrid vehicles. Overwrite this value to customize the growth rate.
<b>Plug-In 20 Gasoline Hybrid Share of Electric Miles (%)</b>	Percent of electric miles for plug-in hybrids with electric range of 20 miles. Default (23%) from 2010 National Academies of Science report <sup>6</sup>
<b>Plug-In 50 Gasoline Hybrid Share of Electric Miles (%)</b>	Percent of electric miles for plug-in hybrids with electric range of 50 miles. Default (63%) from 2010 National Academies of Science report <sup>7</sup>
<b>Annual Change in Vehicle Stock Fuel Economy (MPG) (%)</b>	The default is the average forecast fuel economy change. Overriding this sets a constant fuel economy change for all years.
<b>Annual Change in VMT (%)</b>	The default is the average forecast VMT change. Overriding this sets a constant VMT change for all years.

<sup>6</sup> See [http://books.nap.edu/catalog.php?record\\_id=12826](http://books.nap.edu/catalog.php?record_id=12826)

<sup>7</sup> See [http://books.nap.edu/catalog.php?record\\_id=12826](http://books.nap.edu/catalog.php?record_id=12826)

## Optional Revenue Settings

Input Field	Description
<b>Baseline Gasoline Tax (\$/gallon)</b>	Tax rates are as of December 31 <sup>st</sup> . Includes inspection fees and environmental cleanup fees when fees are targeted at highway fuel use. Includes local taxes when taxes are uniform across all the counties in the state. Does not include federal taxes.
<b>Baseline Diesel Tax (\$/gallon)</b>	This field is not supported in the current version of the model.
<b>Electric Vehicle Fuel Economy Equivalent (MPGe)</b>	This option is only relevant when Electric Vehicle Annual Fee is set to “Index to MPGe.” In that case, this field can override the estimated fuel economy of electric vehicles. This can be helpful if you wish to index electric vehicle fees to a vehicle with a lower fuel economy (e.g., a hybrid electric vehicle).
<b>Index Motor Fuel Tax to Inflation (Yes/No)</b>	When the user selects this option, the motor fuel tax will be indexed to fleet-wide fuel use which incorporates fuel economy, VMT, and vehicle stock.
<b>Electric and Hybrid Vehicle Annual Fee</b>	Set the option to generate revenue from electric and hybrid vehicles.
<b>Vehicle Fee</b>	<p>Set the option to generate revenue from electric vehicles. If Indexed to MPGe is selected, then the fee for vehicles will be indexed to the fuel economy of EVs. Further input is needed if Fixed option is chosen:</p> <ul style="list-style-type: none"> <li>• Battery Electric Vehicle Fee: one-time or annual fee for BEVs</li> <li>• Hybrid Vehicle Fee: one-time or annual fee for hybrid vehicles.</li> <li>• Plug-In Hybrid Electric Vehicle Fee: one-time or annual fee for PHEVs</li> </ul>

# Appendix B: Calculations

Terms:

**RTR – Real Motor Fuel Tax and EV Fee Revenue**

**EVR – Electric Vehicle Fee Revenue**

## Market and vehicle forecast calculations

Factor	Formula
Inflation (%)	Derived directly from EIA data
<b>Gasoline Vehicle Stock Reference (million vehicles) [The total number of gasoline vehicles in the country]</b>	Derived directly from EIA data
<b>Battery Electric Vehicles Stock Reference (million vehicles) [The total number of battery electric vehicles in the country]</b>	Derived directly from EIA data
<b>Plug-in 20 Gasoline Hybrid Stock Reference (million vehicles) [The total number of plug-in 20 hybrid vehicles in the country]</b>	Derived directly from EIA data
<b>Plug-in 50 Gasoline Hybrid Stock Reference (million vehicles) [The total number of plug-in 50 hybrid vehicles in the country]</b>	Derived directly from EIA data
<b>Hybrid Electric Vehicles Stock Reference (million vehicles) [The total number of hybrid vehicles in the country]</b>	Derived directly from EIA data
<b>Gasoline Vehicles Stock Proxy (vehicles) [An estimate of the</b>	$\frac{(\text{Baseline Motor Fuel Tax Revenue} \times \text{Vehicle Stock Fuel Economy})}{(\text{State Gasoline Tax} \times \text{VMT})}$



Factor	Formula
<b>gasoline vehicle stock in inputted state] (First Year)</b>	
<b>Gasoline Vehicles Stock Proxy (vehicles) [An estimate of the gasoline vehicle stock in inputted state] (Modeled years)</b>	$(1 + \% \text{ Change in Gas Vehicle Stock Reference}_{\text{Prev Year} - \text{Curr Year}}) \times \text{Gas Vehicle Stock Proxy}$
<b>Battery Electric Vehicles Stock Proxy (vehicles)</b>	$\text{Gasoline Vehicles Stock Proxy} \times \frac{\text{BEV Stock Reference}}{\text{Gasoline Vehicle Stock Reference}}$
<b>Plug-in 20 Gasoline Hybrid Stock Proxy (vehicles)</b>	$\text{Gasoline Vehicles Stock Proxy} \times \frac{\text{Plug - in 20 Gasoline Hybrid Stock Reference}}{\text{Gasoline Vehicle Stock Reference}}$
<b>Plug-in 50 Gasoline Hybrid Stock Proxy (vehicles)</b>	$\text{Gasoline Vehicles Stock Proxy} \times \frac{\text{Plug - in 50 Gasoline Hybrid Stock Reference}}{\text{Gasoline Vehicle Stock Reference}}$
<b>Hybrid Electric Vehicles Stock Proxy (vehicles)</b>	$\text{Gasoline Vehicles Stock Proxy} \times \frac{\text{Hybrid Vehicle Stock Reference}}{\text{Gasoline Vehicle Stock Reference}}$
<b>Electric Vehicles Stock Proxy (vehicles)</b>	$\text{BEV Stock Proxy} + \text{Plug} - \text{in 20 Hybrid Stock Proxy} + \text{Plug} - \text{in 50 Hybrid Stock Proxy}$
<b>Advanced Vehicles Stock Proxy (vehicles)</b>	$\text{BEV Stock Proxy} + \text{Plug} - \text{in 20 Hybrid Stock Proxy} + \text{Plug} - \text{in 50 Hybrid Stock Proxy} + \text{Hybrid Stock Proxy}$
<b>Battery Electric Vehicle Fuel Economy (MPG)</b>	Derived directly from EIA data
<b>Vehicle Stock Fuel Economy (MPG)</b>	Derived directly from EIA data
<b>VMT</b>	Derived directly from EIA data

Factor	Formula
Estimated Gasoline Use (Gallons)	$\frac{VMT}{Vehicle\ Stock\ Fuel\ Economy\ (MPG)} \times Gas\ Vehicle\ Stock$

## Highway revenue gain/loss forecast calculations

### Baseline Motor Fuel Tax Revenue

Factor	Formula
Highway User Tax Revenue (\$)	Derived directly from EIA Data
Baseline Motor Fuel Revenue (\$) (First Year)	$Highway\ User\ Tax\ Revenue \times Share\ of\ Highway - User\ Revenue$
Baseline Motor Fuel Revenue (\$) (Modeled Years)	$\frac{VMT}{Vehicle\ Stock\ Fuel\ Economy} \times State\ Gasoline\ Tax \times Gas\ Vehicles\ Stock\ Proxy$
Change from Baseline Motor Fuel Tax Revenue (\$)	$Baseline\ Motor\ Fuel\ Revenue_{Curr\ Year} - Baseline\ Motor\ Fuel\ Revenue_{Base\ Year}$
Change from Baseline Motor Fuel Tax Revenue (%)	$\frac{Change\ from\ Baseline\ Motor\ Fuel\ Revenue_{Curr\ Year}}{Baseline\ Motor\ Fuel\ Revenue_{Base\ Year}}$

### Adjusted Motor Fuel Tax and Advanced Vehicle Fee Revenue

Factor	Formula
Adjusted Motor Fuel Tax and Advanced Vehicle Fee Revenue (\$)	$(Baseline\ Motor\ Fuel\ Revenue * (1 + Inflation\ Rate)) + Advanced\ Fee\ Revenue$
Change from Adjusted Motor Fuel	$Adjusted\ Motor\ Fuel\ Tax\ and\ Advanced\ Fee\ Revenue_{Curr\ Year} - Adjusted\ Motor\ Fuel\ Tax\ and\ Advanced\ Fee\ Revenue_{Base\ Year}$

Factor	Formula
<b>Tax and Advanced Vehicle Fee Revenue Gain/Loss (\$)</b>	
<b>Change from Adjusted Motor Fuel Tax and Electric Vehicle Fee Revenue Gain/Loss (%)</b>	$\frac{\text{Change from Adjusted Motor Fuel Tax and Advanced Fee Revenue}_{\text{Curr Year}}}{\text{Adjusted Motor Fuel Tax and Advanced Fee Revenue}_{\text{Base Year}}}$
<b>BEV Revenue (\$)</b>	$\frac{\text{BEV Stock Reference}}{\text{Gas Vehicle Stock Reference}} \times \text{Gas Vehicle Stock Proxy} \times \text{BEV Fee}$
<b>PHEV-20 Revenue (\$)</b>	$\frac{\text{PHEV} - 20 \text{ Stock Reference}}{\text{Gas Vehicle Stock Reference}} \times \text{Gas Vehicle Stock Proxy} \times \text{PHEV} - 20 \text{ Fee}$
<b>PHEV-50 Revenue (\$)</b>	$\frac{\text{PHEV} - 50 \text{ Stock Reference}}{\text{Gas Vehicle Stock Reference}} \times \text{Gas Vehicle Stock Proxy} \times \text{PHEV} - 50 \text{ Fee}$
<b>Hybrid Vehicle Revenue (\$)</b>	$\frac{\text{Hybrid Stock Reference}}{\text{Gas Vehicle Stock Reference}} \times \text{Gas Vehicle Stock Proxy} \times \text{Hybrid Fee}$
<b>Advanced Vehicle Fee Revenue</b>	$\text{BEV Revenue} + \text{PHEV} - 20 \text{ Revenue} + \text{PHEV} - 50 \text{ Revenue} + \text{Hybrid Revenue}$

### Motor Fuel Tax and Electric Vehicle Fee Revenue Levels

Factor	Formula
<b>State Gasoline Tax (\$/Gallon) (Indexed to inflation)</b>	$\text{Tax}_{\text{Current Year}} = \text{Tax}_{\text{Previous Year}} \times (1 + \text{Inflation Rate}_{\text{Current Year}})$
<b>State Gasoline Tax (\$/Gallon) (Indexed to fuel use)</b>	$\text{Tax}_{\text{Current Year}} = \frac{\text{RTR} - \text{EVR} - (\text{Inflation Adjusted RTR}_{\text{Prev Year}} - \text{Inflation Adjusted RTR}_{\text{First Year}})}{\text{Estimated Gasoline Use}_{\text{Prev Year}}}$

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<b>Annual BEV Fee (\$/vehicle)</b>	Input from user
<b>Annual Plug-in Hybrid EV Fee (\$/vehicle)</b>	Input from user
<b>Annual Hybrid Fee (\$/vehicle)</b>	Input from user

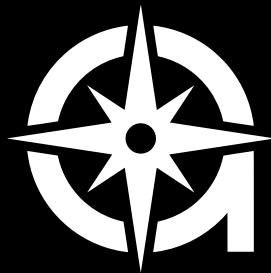
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# Appendix C: Version History

Version	Date	Author	Organization	Revisions
0.1	12/24/2019	Nick Nigro	<a href="#">Atlas Public Policy</a>	Initial Beta Release
1.0	4/30/2020	Nick Nigro	<a href="#">Atlas Public Policy</a>	Initial Release. Since Beta release, completed bug fixing. Added multivariate scenario analysis support (undocumented feature). Added Custom Scenarios feature.
1.1	5/20/2020	Josh Rosenberg	<a href="#">Atlas Public Policy</a>	Fixed bug related to updating default inputs in the optional revenue settings. Added average annual % change to outputs.
1.2	6/2/2020	Josh Rosenberg	<a href="#">Atlas Public Policy</a>	Fixed bug introduced in version 1.1 relating to how Gasoline Vehicles Stock Proxy, an estimate of the number of vehicles on the road in the first year, is calculated.
1.3	6/11/2020	Josh Rosenberg	<a href="#">Atlas Public Policy</a>	Fixed bug related to an improper calculation of gasoline vehicle stock when indexing fuel use to inflation. Resolved issue with an incorrect calculation of future gasoline tax when indexing to fuel use. Fixed incorrect reference to base year for summary stats.
1.4	3/29/2021	Nick Nigro	<a href="#">Atlas Public Policy</a>	Updated data sources to new baseline year (2019). Updated data with latest information

Version	Date	Author	Organization	Revisions
				from Federal Highway Statistics Series and U.S. Energy Information Administration Annual Energy Outlook for 2020.
1.5	11/10/2021	Nick Nigro	<a href="#">Atlas Public Policy</a>	<p>Changed default gasoline tax accuracy to four significant digits for better rounding. Changed name to gasoline vehicle stock in output to be more accurate. Subtracted EV revenue change from gasoline vehicle stock change to isolate effects of change in these two variables and correct issue in presenting these revenue changes in a stacked bar chart. Added interaction of VMT, fuel economy, and gasoline vehicle stock to outputs to improve accuracy of the source of revenue change. Updated FHWA data to 2019. Changed how baseline revenue is calculated. Use Highway Statistics Series SF-1 as baseline state motor fuel tax revenue used for highways. Multiply that figure by the estimated share of revenue from gasoline taxes, which is calculated as a gasoline share of the tax rate times the fuel consumed for gasoline and diesel taxes.</p>
1.6	11/11/2021	Nick Nigro	<a href="#">Atlas Public Policy</a>	Adjusted field for vehicle that an EV is replacing. This field informs the calculation for the revenue loss attributable to EVs. It

Version	Date	Author	Organization	Revisions
				now defaults to the average fuel economy over the years in the analysis.
1.7	5/5/2025	Nick Nigro	<a href="#">Atlas Public Policy</a>	Update to assumptions using 2022 data from Highway Statistics Series and 2023 U.S. EIA Annual Energy Outlook. Added support for hybrid electric vehicle fee and one-time fee option.



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