

Alternative Revenue Mechanisms: Preliminary Revenue Forecasting

May 12, 2022

Table of Contents

1. Introduction
2. Primary Data Sources
3. Ohio's Vehicle Fleet Composition
4. Ohio Statewide VMT Projections
5. ODOT Cost of Construction
6. Vehicle Fleet Electrification
7. Revenue Generating Capacity of Transportation Funding Mechanisms

1. Introduction

At the first External Advisory Committee (EAC) meeting in March 2022, the CDM Smith team presented a range of traditional and alternative revenue mechanisms for consideration in Ohio. This document provides a preliminary assessment of the revenue generating capacity of each of these mechanisms.

This memo supports material presented at the second EAC meeting in April 2022 by providing additional details on revenue generating capacity of various alternative revenue mechanisms. Material provided at the third EAC meeting will analyze these Alternative Revenue Mechanisms in light of policy goals beyond revenue, and that material can be used in conjunction with this memo to give an accurate overall picture of the impacts of the various mechanisms

The memo starts by summarizing the primary data sources used to conduct the analysis, before focusing on two important elements: vehicle fleet composition and vehicle miles traveled (VMT). Cost of highway construction and vehicle fleet electrification are also discussed to support the revenue analysis.

Next, the revenue analysis is discussed with an overview of the approach, assumptions, methodology, and findings. Each revenue mechanism is presented using a consistent framework that covers the following items: name of revenue mechanism; brief description; revenue calculation formula; key assumptions used in the revenue forecasting process;

estimated revenue potential in 2025 and 2040; net present value 2022-2040; and financial sustainability trend.

The quantitative assessment presented in this memo should be regarded as a preliminary evaluation to support the ongoing discussions and deliberations of the Ohio Department of Transportation (ODOT) and its EAC. The inherent uncertainty in projecting growth rates of tax bases such as vehicles, fuel consumption, and miles traveled leads to uncertainty in revenue projections. As such, this preliminary revenue forecast serves as a starting point based on methodologies and assumptions that will require further validation against baseline data and continual refinement over the next year as the project proceeds. Continued observation of vehicle fleet and travel trends will inform the level of uncertainty of forecasts.

The mechanisms being evaluated as part of this process include:

- **Fuel Tax**
 - Flat per-gallon excise gas tax
 - Flat per-gallon excise diesel tax
 - Gasoline tax with inflation
 - Diesel tax with inflation
 - Gasoline tax with MPG index
 - Diesel tax with MPG index
 - Sales tax on gasoline
 - Sales tax on diesel
 - Variable-rate tax based on gas price
 - Variable-rate tax based on diesel price
- **Vehicle Fees**
 - Basic vehicle registration fee
 - Vehicle value tax
 - Weight-based fee
 - Vehicle fuel efficiency fee
 - Electric vehicle fee
 - Vehicle age fee
- **Direct Usage Fees**
 - Mileage-based user fee (light vehicles)
 - Mileage-based user fee (heavy vehicles)
- **Indirect Usage Fees**
 - Battery fee

- Tire fee
- Electricity tax
- **Externality Taxes**
 - Congestion charge
 - Carbon tax
- **Other Fees**
 - Fee on value of trucking costs
 - Delivery fee on tangible goods
 - For-hire transportation fee
 - Street utility fee
 - Payroll tax
 - Land use impact fee

2. Primary Data Sources

Table 1 summarizes the primary data sources used in this preliminary assessment. Most of the data were obtained following a formal data request to ODOT submitted by CDM Smith on March 1, 2022. Other information was available online such as the data reported by the Federal Highway Administration (FHWA), U.S. Energy Information Administration (EIA), or Bloomberg New Energy Finance (BNEF).

Table 1: Primary Data Sources

Primary Data Type	Sources
Vehicle Miles Traveled (VMT)	FHWA Highway Performance Monitoring System (HPMS) ODOT Planning Division
Vehicle Registrations	FHWA HPMS Ohio Bureau of Motor Vehicles (BMV) ODOT Citizen's Guide to Transportation Funding
Gas Tax	Ohio Department of Taxation
Fuel Efficiency	Ohio BMV U.S. Energy Information Administration (EIA)
Vehicle Fleet Electrification	ODOT's Alternative Fuel Vehicle dashboard Bloomberg New Energy Finance (BNEF)
Fuel Price	EIA
Existing Revenues	ODOT

3. Ohio's Vehicle Fleet Composition

An important source of information used in this analysis is the vehicle registry dataset provided by the Ohio BMV. Many of the revenue mechanisms studied are related to the characteristics of the vehicle fleet in Ohio, such as vehicle age, value, fuel efficiency, engine type or weight. The BMV dataset provided a snapshot of the entire fleet of vehicles registered in Ohio as of March 2022.

The dataset was made available to the CDM Smith team on March 30, 2022. The Vehicle Identification Number (VIN) encodes information on the vehicle's manufacturer, brand, engine size and type, model year, and other characteristics.

CDM Smith performed VIN decoding on this dataset to extract the specific data relevant for revenue analysis. U.S. Environmental Protection Agency (EPA) fuel economy ratings are not directly available through the VIN; in this case, CDM Smith applied an in-house process to determine fuel economy based on decoded VIN data. The decoding process was applied to a total of 11.4 million passenger light-duty vehicles (10,000 pounds or less). It is assumed that light-duty vehicles use gasoline while heavy-duty vehicles use diesel.

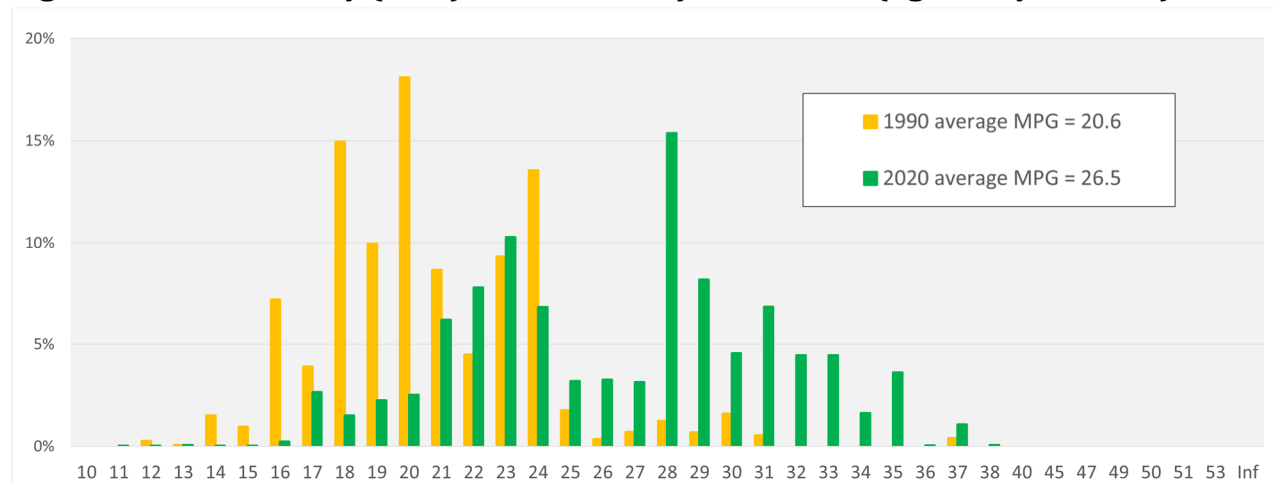
The BMV data were used to develop a snapshot of Ohio's light-duty vehicle fleet composition by:

- model year
- vehicle value (manufacturer's suggested retail price, or MSRP)
- vehicle curb weight
- miles per gallon (MPG) ratings

Figure 1 illustrates the fuel economy distribution of Ohio's light-duty vehicle fleet by model year (only model years 1990 and 2020 are shown here). On average, light-duty vehicles have a fuel economy of 23.7 miles per gallon, which is comparable to the national average of 24.2 MPG.¹ The figure illustrates how the distribution of fuel economy across the fleet has improved over the last three decades, with the curve shifting toward the right and the average moving from 20.6 MPG to 26.5 MPG.

¹ Average US car fuel efficiency according to US Department of Energy (<https://afdc.energy.gov/data/10310>)

Figure 1: Fuel Efficiency (MPG) Distribution by Model Year (light-duty vehicles)



Source: BMV, CDM Smith analysis

4. Ohio Statewide VMT Projections

Distance traveled by vehicles in Ohio, measured in VMT (vehicle miles traveled), is another important element of the analysis. Costs of maintaining and improving Ohio's state roadway system are a function of, in part, VMT. In addition, the revenue mechanisms that fall in the direct usage fee category are proportional to roadway usage.

Some historical data on statewide VMT is available through FHWA publications. For 2020, the source used is the FHWA *Highway Statistics 2020 Series* available at:

<https://www.fhwa.dot.gov/policyinformation/statistics/2020/>

More specifically, the VMT data reported for the state of Ohio came from the following tables:

- **Table VM-2 Annual Vehicle Miles by State - 2020**
<https://www.fhwa.dot.gov/policyinformation/statistics/2020/vm2.cfm>
- **Table VM-4 Distribution of VMT by Vehicle Type (by State) - 2020**
<https://www.fhwa.dot.gov/policyinformation/statistics/2020/vm4.cfm>

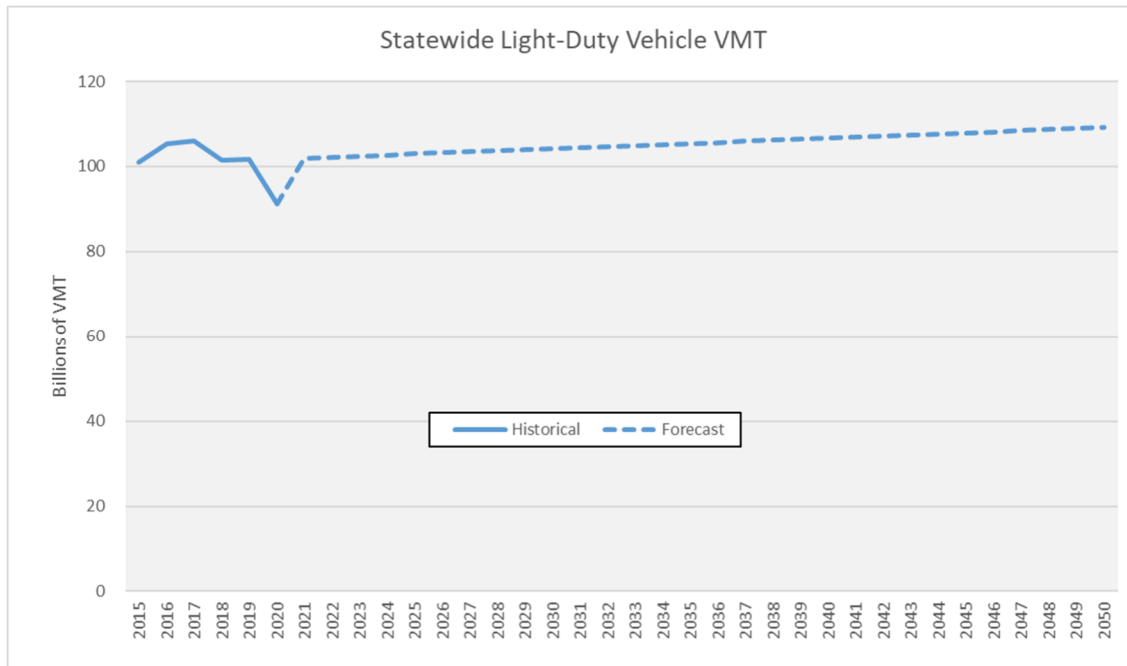
Similar data were gathered for the years 2015-2019 through the relevant annual statistics series, providing a historical VMT trend for the period preceding the COVID-19 pandemic.

Note that at the time this analysis was prepared, no VMT data was available for 2021 in Ohio.

Overall VMT is broken down between light-duty vehicles (10,000 pounds or less) and heavy-duty vehicles (greater than 10,000 pounds) for the purposes of this analysis.

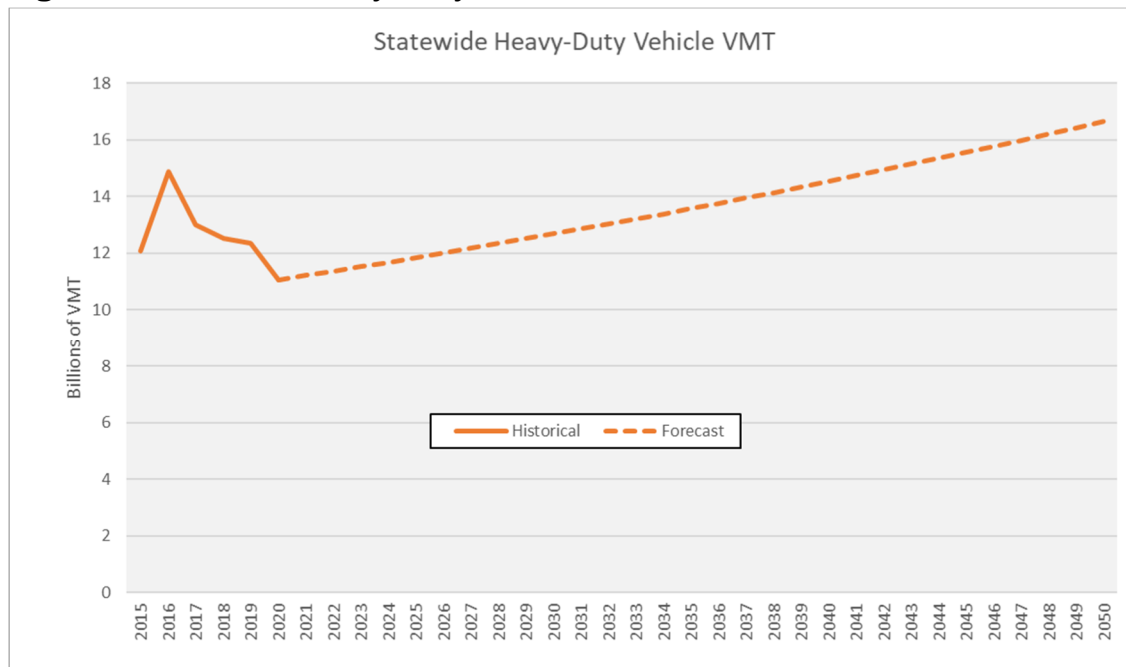
Starting in 2021, the forecasted values for light-duty VMT are based on pre-pandemic trends (2015-2019) since 2020 was highly affected by the travel restrictions due to the pandemic. In absence of reported 2021 VMT data specific to Ohio, it was assumed that 2021 light-duty VMT would be 0.24% higher than 2019's level. The statewide light-duty VMT is expected to continue to grow by 0.24% annually starting in 2022. **Figure 2** illustrates the historical and projected statewide light-duty VMT trend.

Figure 2: Statewide Light-Duty Vehicle VMT



Similarly, forecasted heavy-duty VMT is based on the historical trend over the period 2015-2019. When considering the period from 2015 to 2019, the trend is a 1.37% annual growth. The growth occurred from 2015 to 2016. The statewide heavy-duty VMT is expected to continue to grow by 1.37% annually starting in 2022. **Figure 3** illustrates the historical and projected statewide heavy-duty VMT trends.

Figure 3: Statewide Heavy-Duty Vehicle VMT



Heavy-duty vehicle VMT are expected to outpace light-duty VMT for several reasons. Ohio's population has been and is expected to continue to grow at a relatively modest pace. By contrast, Ohio is a major corridor for interstate freight traffic, including pass-through traffic and traffic originating in Ohio to carry manufacturing and agricultural products to other states. With high expected growth in goods traffic nationally, Ohio's heavy-duty VMT will outpace passenger car VMT. When combining the light-duty and heavy-duty vehicle VMT, the overall annual growth rate is 0.35 to 0.38%. This produces a forecasted statewide VMT of 125.8 billion in 2050.

This value was compared to a forecasted statewide VMT communicated by ODOT's Office of Statewide Planning and Research. ODOT's estimated value is 332,253 daily VMT in 2050, or 121.3 billion annually. The difference between the two methods is only 4 percent, which is considered acceptable given the level of uncertainty associated with VMT forecasting.

5. ODOT Cost of Construction

ODOT's Construction Division measures a construction cost index that includes prices of the following: labor; trucking costs; contractor and supplier margins; oil, diesel and natural gas; liquid asphalt; steel; ready mix concrete; aggregate.

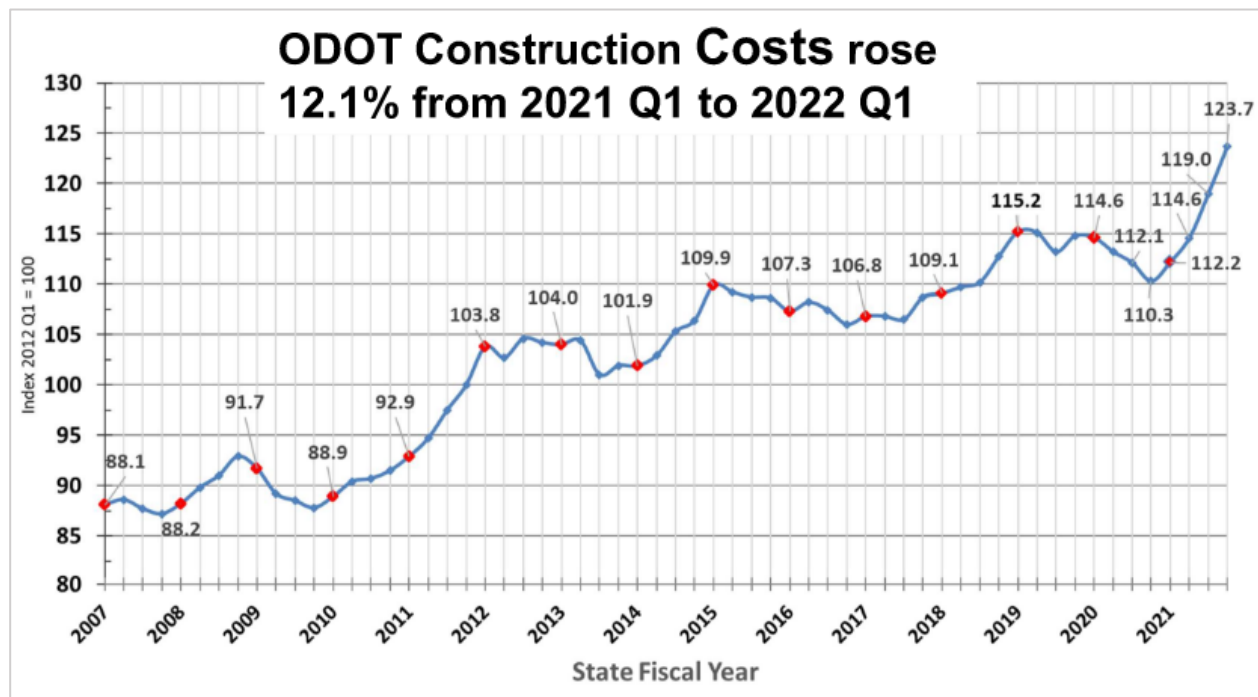
Figure 4 shows how this construction cost index has evolved since 2007, using an index of 100 in 2012 Q1. Over the period 2007 Q1 through 2022 Q1, the index increased by 40 percent from 88.1 to 123.7.

Over the last year (comparing 2022 Q1 to 2021 Q1), the construction cost index increased by 12.1 percent. Year-over-year increases in asphalt, steel, and structures are the most significant factors that raised overall inflation in CY2021. The COVID-19 pandemic affected all aspects of construction in 2021 and is expected to continue affecting construction costs through 2022.

As of January 2022, ODOT predicted construction cost inflation to be 8% in CY2022. Inflation is expected to be 3.7% in CY2023; 2.5% in CY2024; 3.2% in CY2025; and 3.5% in CY2026. From CY2027 through CY2031 inflation is forecast to be 3.0%, based upon average rates over 30 to 60 years as measured by the GDP deflator and the Consumer Price Index (CPI). The long-term forecast beyond CY2031 is 2.0%, based on the Federal Reserve's long run inflation target rate.

The following is a narrative of major factors that will have an influence on construction costs through the forecast period: (1) economic activities globally, nationally, and throughout the state and (2) regional construction costs for labor, oil and diesel, liquid asphalt, and steel, among others (Source: ODOT, January 2022 Construction Cost Outlook and Forecast).

Figure 4: ODOT Construction Cost Index (2007-2022)



Source: ODOT Construction Division

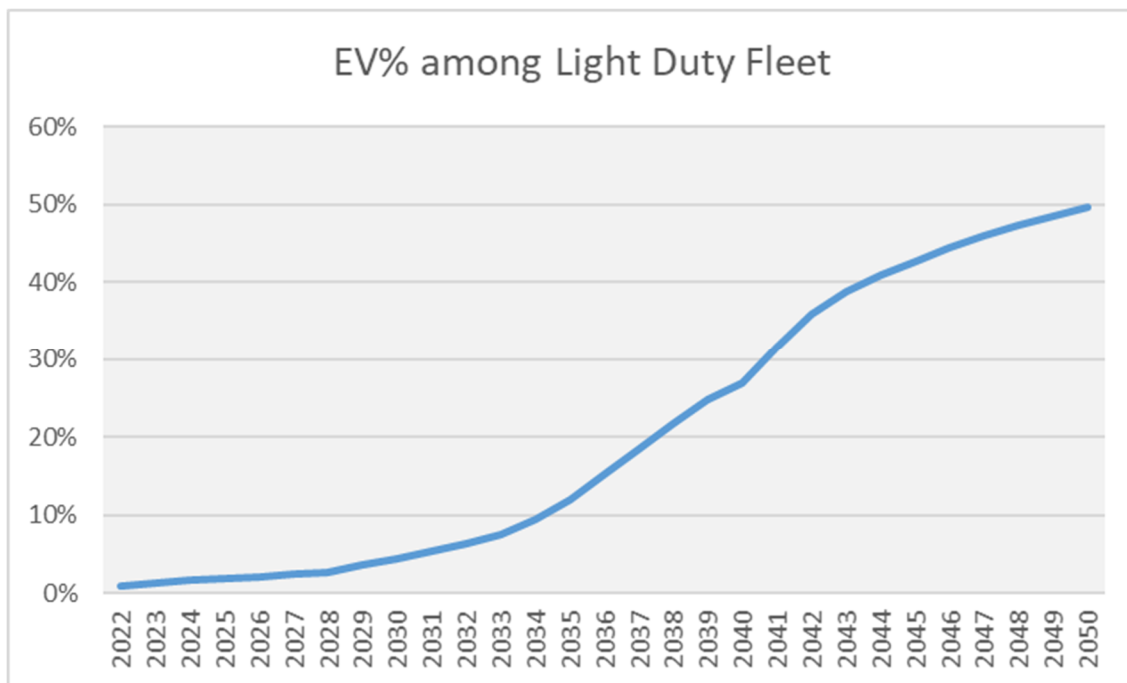
6. Vehicle Fleet Electrification

The number of electric vehicles in operation in Ohio is another important component of future revenue analysis.

DriveOhio is an initiative of ODOT, who worked with the Ohio BMV to develop an alternative fuel vehicle (AFV) registration dashboard to track the latest trends in alternative fuel vehicles across Ohio. The current number of electric vehicles was obtained through the AFV dashboard.

The Electric Vehicle Outlook is BNEF's annual long-term publication looking at how electrification, shared mobility and autonomous driving will impact road transport from now out to 2050. CDM Smith used the BNEF projections to forecast the share of light-duty vehicles that will be electric each year, with the short-term years adjusted to fit the current number of reported electric vehicles in the fleet. **Figure 5** depicts the BNEF projections, showing that half of the light-duty vehicle fleet in operation will be electric by 2050.

Figure 5: Share of Electric Vehicles among Light-Duty Fleet



Source: Bloomberg New Energy Finance (BNEF)

7. Revenue Generating Capacity of Transportation Funding Mechanisms

The revenue generating capacity of existing and alternative transportation funding mechanism was evaluated using two criteria: revenue potential and financial sustainability. Revenue potential measures the relative ability of a mechanism to generate sufficient revenue to fund Ohio's transportation needs at any given time. By contrast, financial sustainability measures the relative ability of a mechanism to keep pace with needs over long periods of time.

Revenue Potential

To measure the revenue potential of each mechanism, a methodology was developed to estimate the revenue in years 2022 through 2040. For revenue sources already in place in Ohio (for instance the gas tax, vehicle registration fees, EV registration surcharge), current tax rates/fees were assumed to remain in place. For new mechanisms, a tax rate or fee level deemed reasonable was applied, whenever possible based on experience from other states. Revenue calculation formulas, as well as assumptions used, are documented in the rest of this memo (one page for each revenue mechanism). The reported revenue potential in 2025 and 2040 is summarized in **Table 2**.

Table 2 also presents the revenue generation potential over the period 2022-2040, measured by the net present value at a 4% discount rate.

Financial Sustainability

To measure the financial sustainability of each revenue mechanism, the expected revenue stream over time was compared against projected statewide VMT, which represents the roadway usage and serves as a proxy for long-term investment needs. The values of both VMT and expected revenue were indexed to 100 in year 2022, then the trends through 2040 were compared.

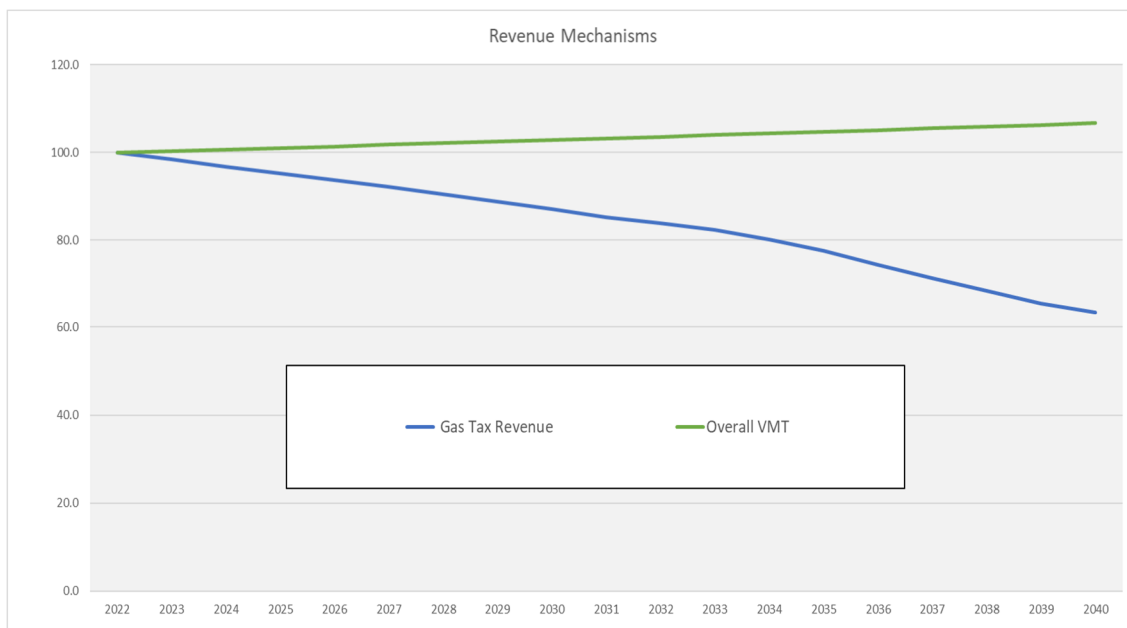
Total statewide VMT (combining light-duty and heavy-duty vehicles) is expected to grow by 6.7% over the time frame 2022-2040. Revenue mechanisms that keep pace with or exceed VMT growth are regarded as "sustainable." Mechanisms that diverge from VMT are regarded as unsustainable.

Table 2: Revenue Potential Summary (in millions of dollars)

Group	Mechanism	2025 Revenue Potential	2040 Revenue Potential	NPV (2022-2040)
Fuel Tax	Flat per-gallon excise gas tax	\$ 1,556	\$ 1,039	\$ 18,507
	Flat per-gallon excise diesel tax	\$ 722	\$ 717	\$ 9,370
	Gasoline tax with inflation	\$ 1,685	\$ 1,513	\$ 21,879
	Diesel tax with inflation	\$ 782	\$ 1,045	\$ 11,216
	Gasoline tax with MPG index	\$ 1,665	\$ 1,273	\$ 20,761
	Diesel tax with MPG index	\$ 759	\$ 931	\$ 10,679
	Sales tax on gasoline	\$ 689	\$ 657	\$ 9,124
	Sales tax on diesel	\$ 320	\$ 468	\$ 4,746
	Variable-rate tax based on gas price	\$ 643	\$ 612	\$ 8,504
	Variable-rate tax based diesel price	\$ 300	\$ 438	\$ 4,449
Vehicle Fees	Basic vehicle registration fee	\$ 786	\$ 867	\$ 10,662
	Vehicle value tax	\$ 350	\$ 520	\$ 5,278
	Weight-based fee	\$ 135	\$ 161	\$ 1,881
	Vehicle fuel efficiency fee	\$ 246	\$ 252	\$ 3,403
	Electric vehicle fee	\$ 22	\$ 694	\$ 2,284
	Vehicle age fee	\$ 413	\$ 454	\$ 5,661
Direct Usage Fees	MBUF (light vehicles)	\$ 1,674	\$ 1,735	\$ 22,244
	Heavy vehicle usage charge	\$ 759	\$ 931	\$ 10,679
Indirect Usage Fees	Battery fee	\$ 23	\$ 19	\$ 294
	Tire fee	\$ 47	\$ 52	\$ 634
	Electricity tax	\$ 6	\$ 172	\$ 577
Externality Taxes	Congestion charge	\$ 545	\$ 865	\$ 8,421
	Carbon tax	\$ 810	\$ 614	\$ 9,880
Other Fees	Fee on value of trucking costs	\$ 364	\$ 446	\$ 5,114
	Delivery fee on tangible goods	\$ 306	\$ 512	\$ 4,822
	For-hire transportation fee	\$ 23	\$ 38	\$ 358
	Street utility fee	\$ 142	\$ 146	\$ 1,883
	Payroll tax	\$ 339	\$ 523	\$ 5,183
	Land use impact fee	\$ 224	\$ 260	\$ 3,090

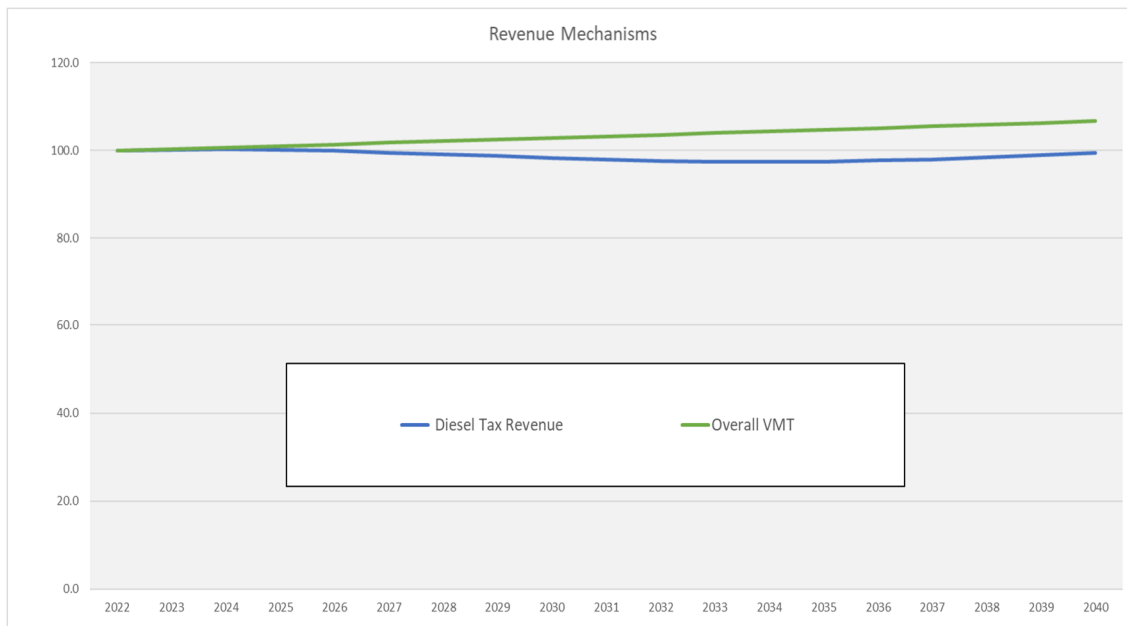
Flat per-gallon excise gas tax

Description	State gas tax at current rate
Revenue formula	Tax rate x Gross taxable gasoline gallons
Key assumptions	Stays at \$0.385 per gallon
Revenue potential	
2025	\$1,556,000,000
2040	\$1,039,000,000
2022-2040 NPV	\$18,507,000,000
Sustainability	Revenue declines relative to roadway usage reaching 43% less in 2040 due to fuel efficiency improvements and increase in electrification



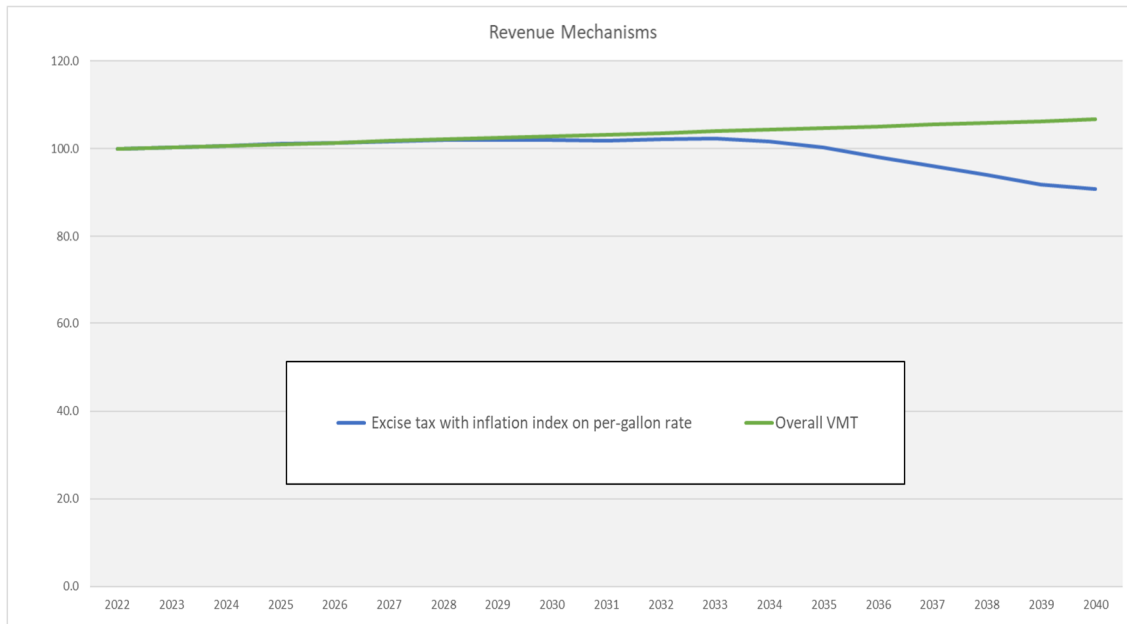
Flat per-gallon excise diesel tax

Description	State diesel tax at current rate
Revenue formula	Tax rate x Gross taxable diesel gallons
Key assumptions	Stays at \$0.47 per gallon
Revenue potential	
	2025 \$722,000,000
	2040 \$717,000,000
	2022-2040 NPV \$9,370,000,000
Sustainability	Revenue declines relative to roadway usage until 2034 then increases due to heavy-duty VMT increasing faster than heavy-duty fuel economy



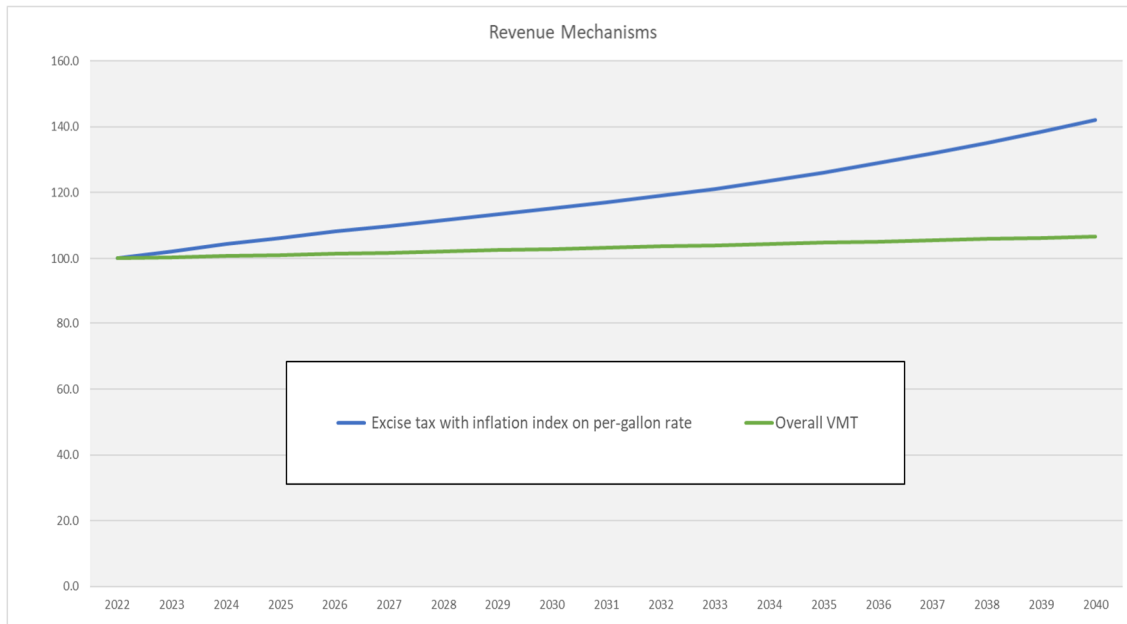
Excise tax with inflation index on per-gallon gas tax rate

Description	Add inflation index to flat per-gallon gas excise tax rate
Revenue formula	Tax rate x CPI x Gross taxable gasoline gallons
Key assumptions	CPI 2% per year, starting at \$0.385 in 2021
Revenue potential	
	2025 \$1,685,000,000
	2040 \$1,513,000,000
	2022-2040 NPV \$21,879,000,000
Sustainability	Revenue on pace with roadway usage until 2033, then declines due to fuel economy improvements and increase in electrification



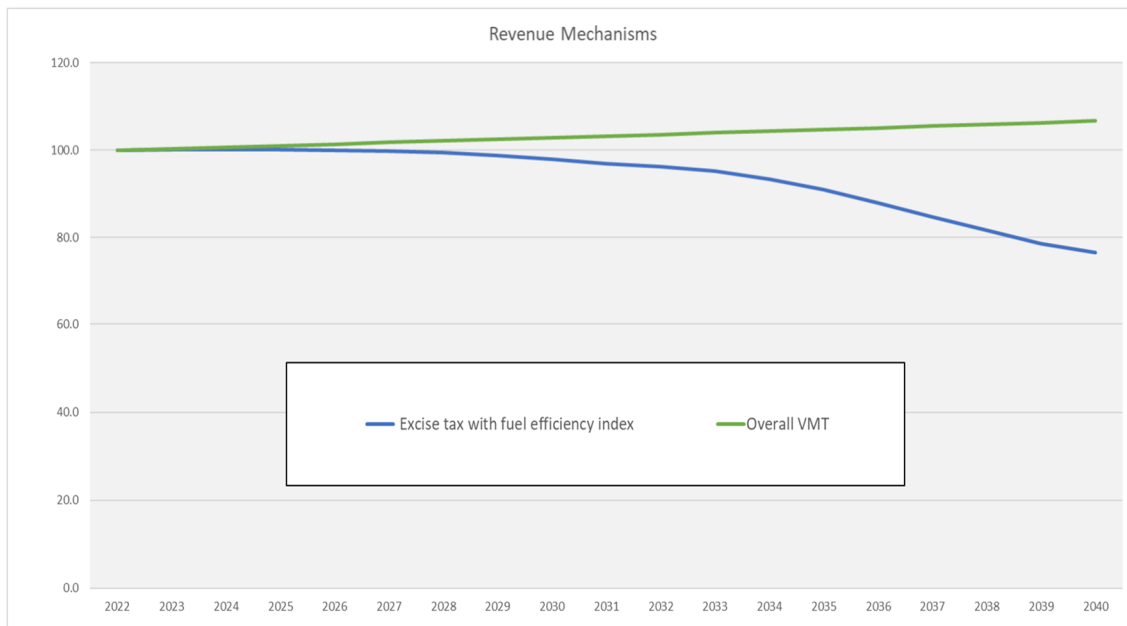
Excise tax with inflation index on per-gallon diesel tax rate

Description	Add inflation index to flat per-gallon diesel excise tax rate
Revenue formula	Tax rate x CPI x Gross taxable diesel gallons
Key assumptions	CPI 2% per year, starting at \$0.47 in 2021
Revenue potential	
	2025 \$782,000,000
	2040 \$1,045,000,000
	2022-2040 NPV \$11,216,000,000
Sustainability	Revenue increases faster than roadway usage due to inflation index and truck VMT increase outpacing heavy-duty fuel economy



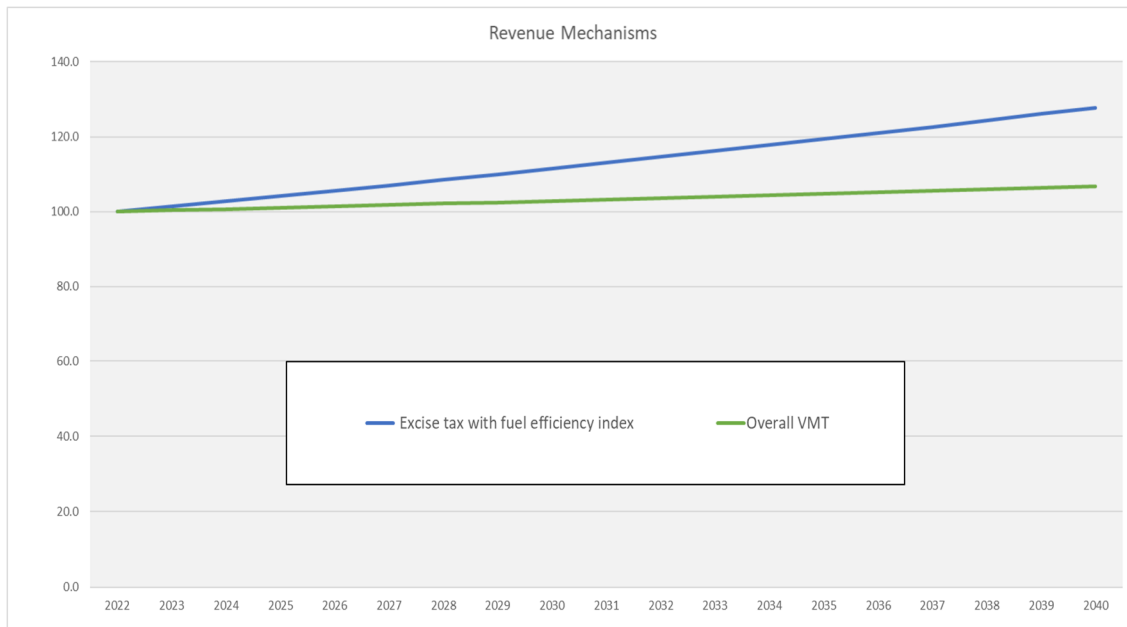
Excise tax with fuel efficiency index – Gasoline

Description	Add vehicle fuel economy index to flat per-gallon fuel excise tax rate. Gas tax rate would increase at the rate of the light duty fleet MPG increase.
Revenue formula	Excise tax rate x Fleet fuel economy increase from 2021
Key assumptions	Starting 2021, light-duty fuel economy increase index
Revenue potential	
	2025 \$1,665,000,000
	2040 \$1,273,000,000
	2022-2040 NPV \$20,761,000,000
Sustainability	Revenue declines relative to roadway usage reaching 30% less in 2040 due to increase in electrification



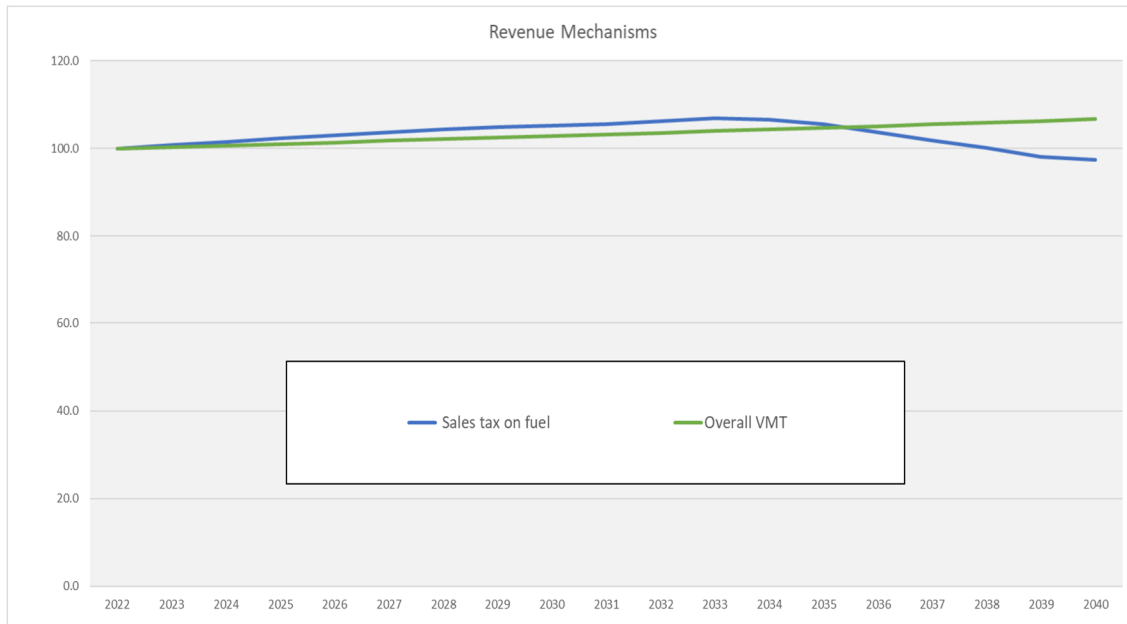
Excise tax with fuel efficiency index – Diesel

Description	Add vehicle fuel economy index to flat per-gallon diesel excise tax rate
Revenue formula	Excise tax rate x Fleet fuel economy increase from 2021
Key assumptions	Starting 2021, heavy-duty fuel economy increase index
Revenue potential	
	2025 \$759,000,000
	2040 \$931,000,000
	2022-2040 NPV \$10,679,000,000
Sustainability	Revenue increases relative to roadway usage



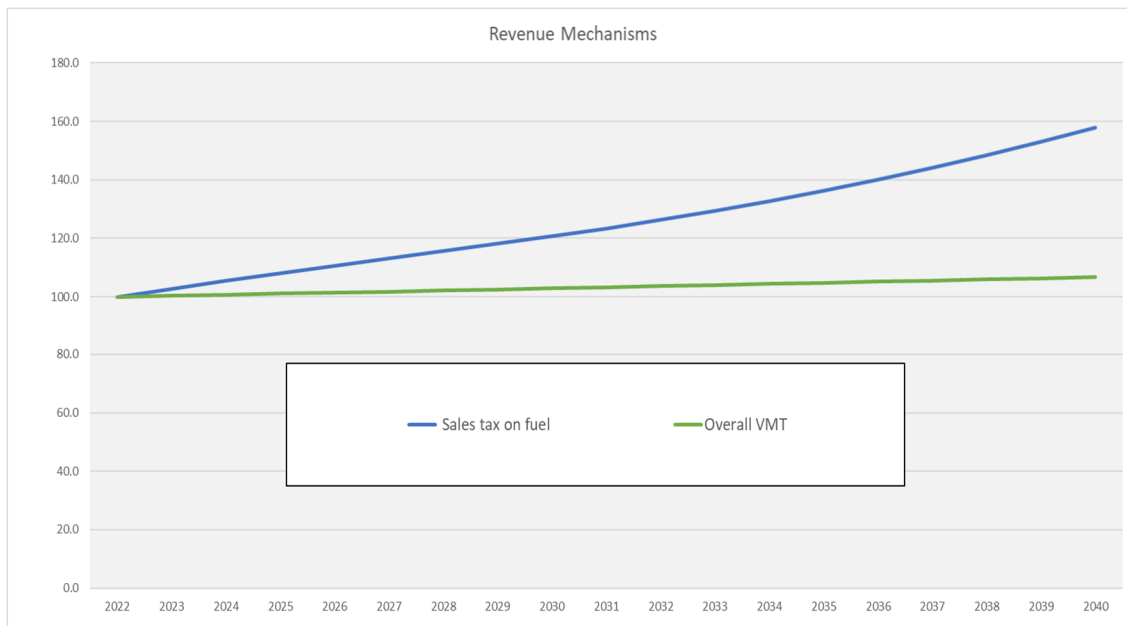
Sales tax on gasoline price

Description	Add a sales tax at the point of purchase, applied to the spot price of gasoline
Revenue formula	$\% \text{ sales tax} \times \text{Gross taxable gasoline gallons} \times \text{Spot price of gasoline as of 4/4/22} \times \text{CPI}$
Key assumptions	<p>3.8% sales tax</p> <p>\$4.18 average U.S. gasoline price on 4/4/22 (source: EIA)</p> <p>2.4% annual growth (source: EIA)</p>
Revenue potential	<p>2025 \$689,000,000</p> <p>2040 \$657,000,000</p> <p>2022-2040 NPV \$9,124,000,000</p>
Sustainability	Revenue on pace with roadway usage until 2035, then declines reaching 9% less in 2040



Sales tax on diesel price

Description	Add a sales tax at the point of purchase, applied to the spot price of diesel
Revenue formula	% sales tax x Gross taxable diesel gallons x Spot price of diesel as of 4/4/22 x CPI
Key assumptions	<p>3.8% sales tax</p> <p>\$5.08 average US diesel price on 4/4/22 (source: EIA)</p> <p>2.6% annual growth (source: EIA)</p>
Revenue potential	<p>2025 \$320,000,000</p> <p>2040 \$468,000,000</p> <p>2022-2040 NPV \$4,746,000,000</p>
Sustainability	Revenue increases relative to roadway usage



Variable-rate tax based on the price of gasoline

Description Add variable-rate excise tax based on the price of gasoline. The tax rate is set periodically, for example yearly, based on the average price of gas over the preceding year or the expected average price over the coming year (note: this mechanism differs from a sales tax by “smoothing” short-term changes in fuel prices, but over the long term for forecasting purposes generates identical revenue)

Revenue formula % tax x Gross taxable gasoline gallons x Wholesale price of gasoline as of 4/4/22

Key assumptions 4.7% tax rate
\$3.15 NY Harbor wholesale gasoline price on 4/4/22 (source: EIA)
2.4% annual growth (source: EIA)

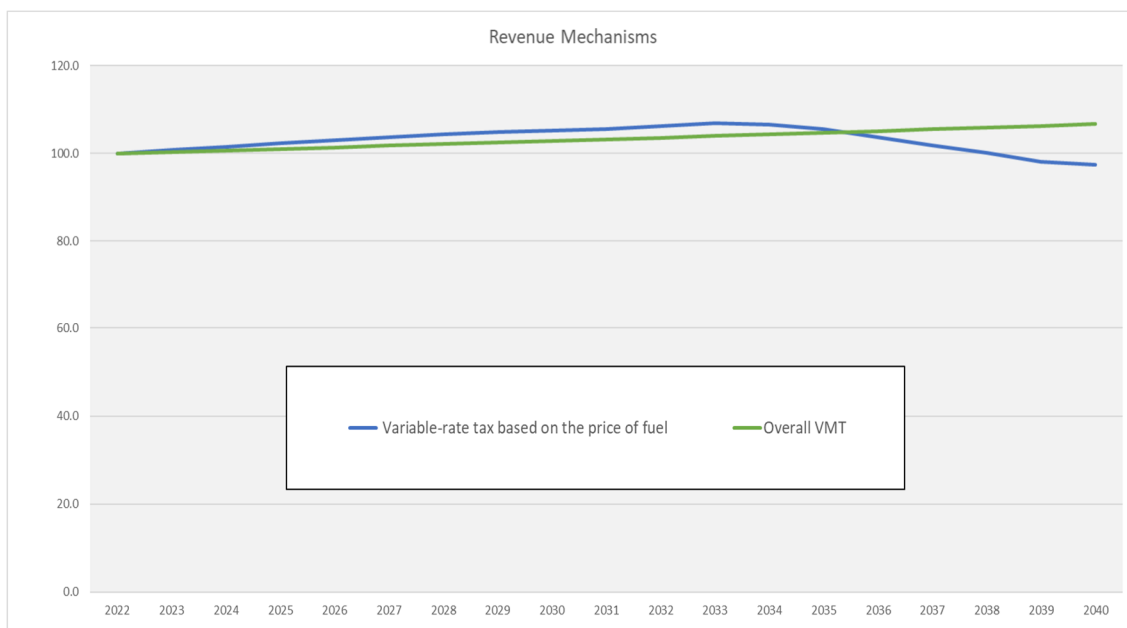
Revenue potential

2025 \$643,000,000

2040 \$612,000,000

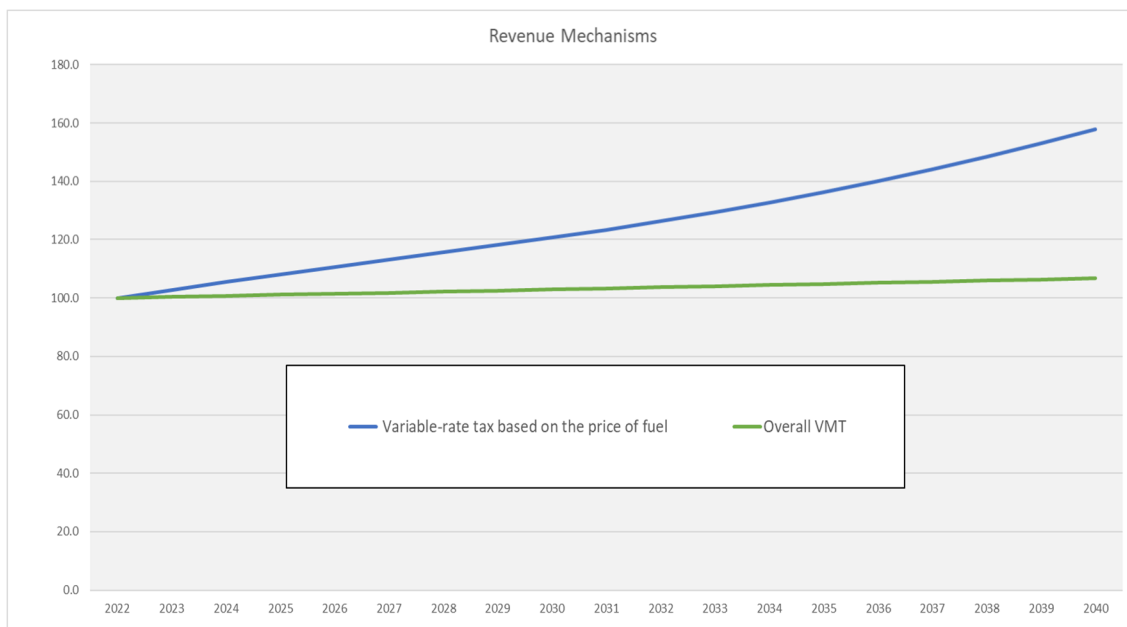
2022-2040 NPV \$8,504,000,000

Sustainability Revenue on pace with roadway usage until 2035, then declines reaching 9% less in 2040



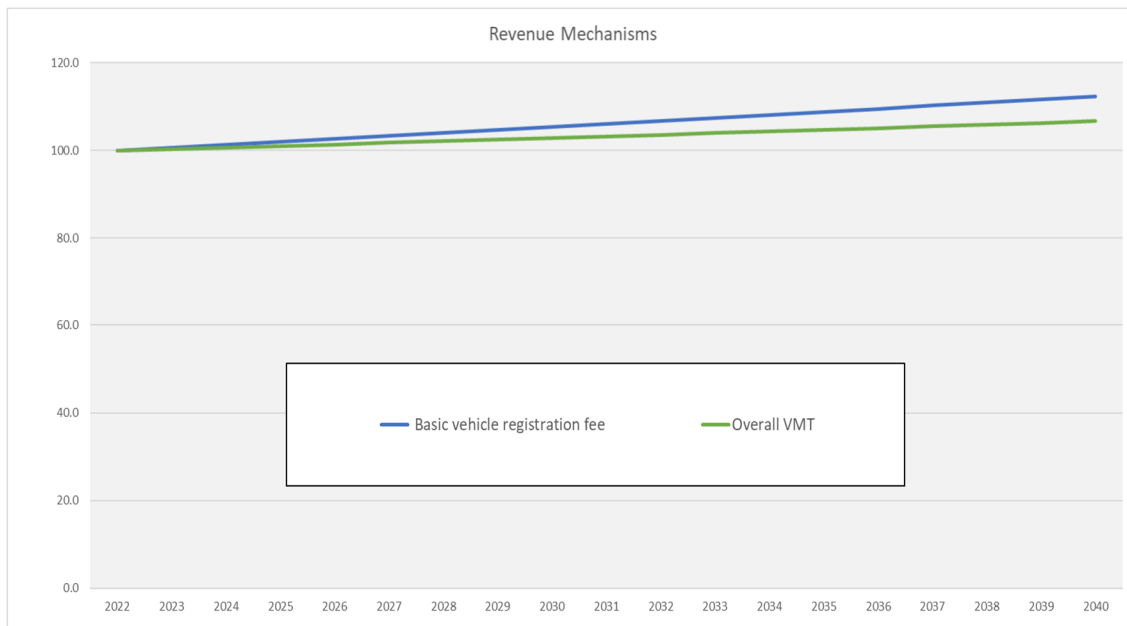
Variable-rate tax based on the price of diesel

Description	Add variable-rate excise tax based on the price of diesel. The tax rate is set periodically, for example yearly, based on the average price of diesel over the preceding year or the expected average price over the coming year
Revenue formula	% tax x Gross taxable diesel gallons x Wholesale price of diesel as of 4/4/22
Key assumptions	<p>4.7% tax rate</p> <p>\$3.85 NY Harbor wholesale diesel price on 4/4/22 (source: EIA)</p> <p>2.6% annual growth (source: EIA)</p>
Revenue potential	<p>2025 \$300,000,000</p> <p>2040 \$438,000,000</p> <p>2022-2040 NPV \$4,449,000,000</p>
Sustainability	Revenue increases relative to roadway usage



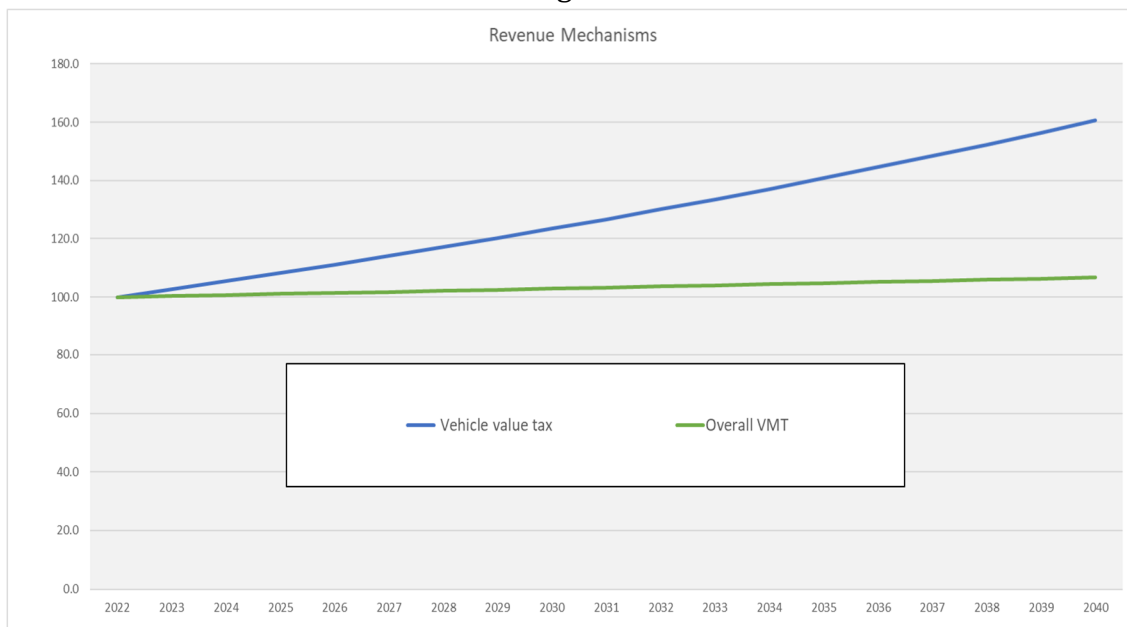
Basic vehicle registration fees

Description	Basic vehicle registration fees for passenger vehicles and light duty trucks
Revenue formula	FY2020 revenue x vehicle fleet expected growth
Key assumptions	<p>\$766 M in 2021 (ODOT's Transportation Funding Guide)</p> <p>11.4M vehicles in 2021 (BMV dataset)</p> <p>0.7% annual growth based on 2016-2019 trend (HPMS)</p>
Revenue potential	<p>2025 \$786,000,000</p> <p>2040 \$867,000,000</p> <p>2022-2040 NPV \$10,662,000,000</p>
Sustainability	Revenue increases relative to roadway usage, reaching 6% higher in 2040



Vehicle value tax

Description	Tax based on the depreciated value of the vehicles, applied to passenger cars and light duty trucks
Revenue formula	Tax rate x Light duty vehicles x Average light duty vehicle value
Key assumptions	0.20% tax rate \$13,800 average depreciated vehicle value in 2021 (BMV dataset) 2% CPI
Revenue potential	
2025	\$350,000,000
2040	\$520,000,000
2022-2040 NPV	\$5,278,000,000
Sustainability	Revenue increases relative to roadway usage due to average vehicle value increasing

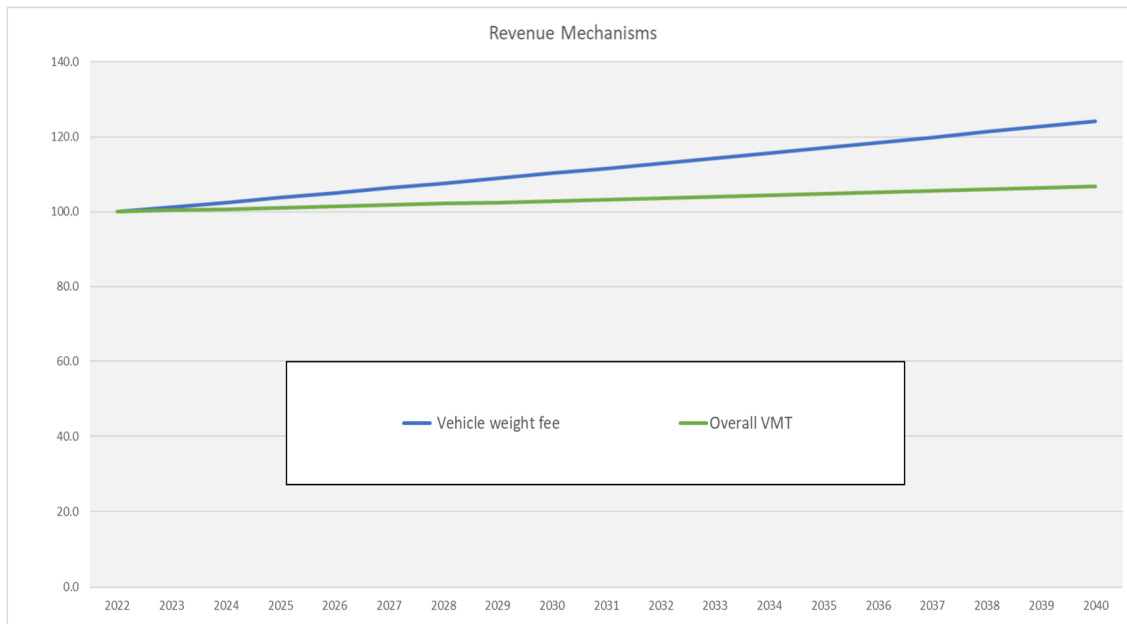


Note about relationship between vehicle value tax and Ohio's real property tax

A vehicle value tax is a form of personal property tax. Some local transportation funding often comes from other property taxes, typically taxes on real property at the local level. In Ohio, real property taxes are the oldest tax, assessed and collected by counties, with rates set by counties, municipalities, school districts, and other local jurisdictions. The state plays a role in ensuring uniformity across jurisdictions for rate setting and administration, but all revenue collected remain in local jurisdictions. Assessing a statewide real property tax would be a departure from long-standing practice; however, local governments can dedicate revenue from property taxes to transportation-related expenditures at the local level.

Weight-based fee

Description	Add fee based on vehicle weight, applied to passenger cars and light duty trucks. Heavier vehicles pay higher registration fees.
Revenue formula	Fee x Number of vehicles (in each bracket)
Key assumptions	<p>Fee by weight class (2 brackets)</p> <p>\$10 for less than 6k lbs</p> <p>\$20 for 6-10k lbs</p> <p>2021 vehicles in each bracket based on BMV dataset</p> <p>Future projections based on historical trends (BMV). Shift towards heavier vehicles is expected since EVs are significantly heavier than internal combustion engine vehicles</p>
Revenue potential	<p>2025 \$135,000,000</p> <p>2040 \$161,000,000</p> <p>2022-2040 NPV \$1,881,000,000</p>
Sustainability	Revenue increases relative to roadway usage due to vehicle weight increasing



Vehicle fuel efficiency fee

Description Add fee based on vehicle fuel economy rating, applied only to internal combustion engine passenger cars and light duty trucks. Higher tax rate on vehicles with a higher EPA-rated MPG

Revenue formula Fee x Number of vehicles (in each bracket)

Key assumptions Fee by MPG class - 5 brackets

Less than 20 MPG: \$10

20-30 MPG: \$20

30-40 MPG: \$30

40-50 MPG: \$40

50+ MPG: \$50

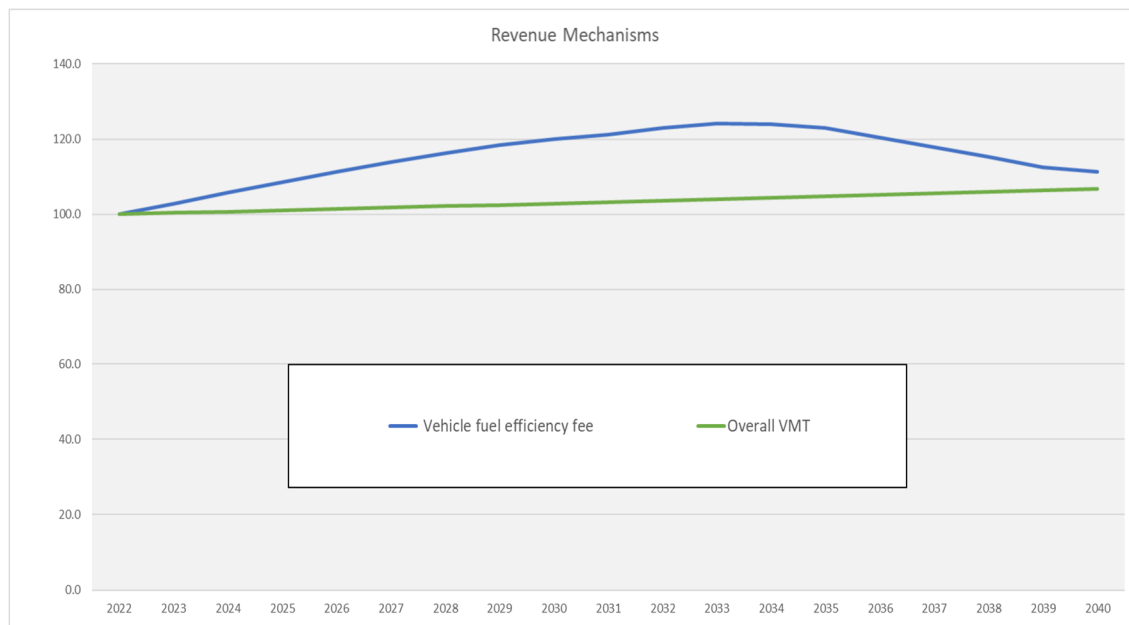
Revenue potential

2025 \$246,000,000

2040 \$252,000,000

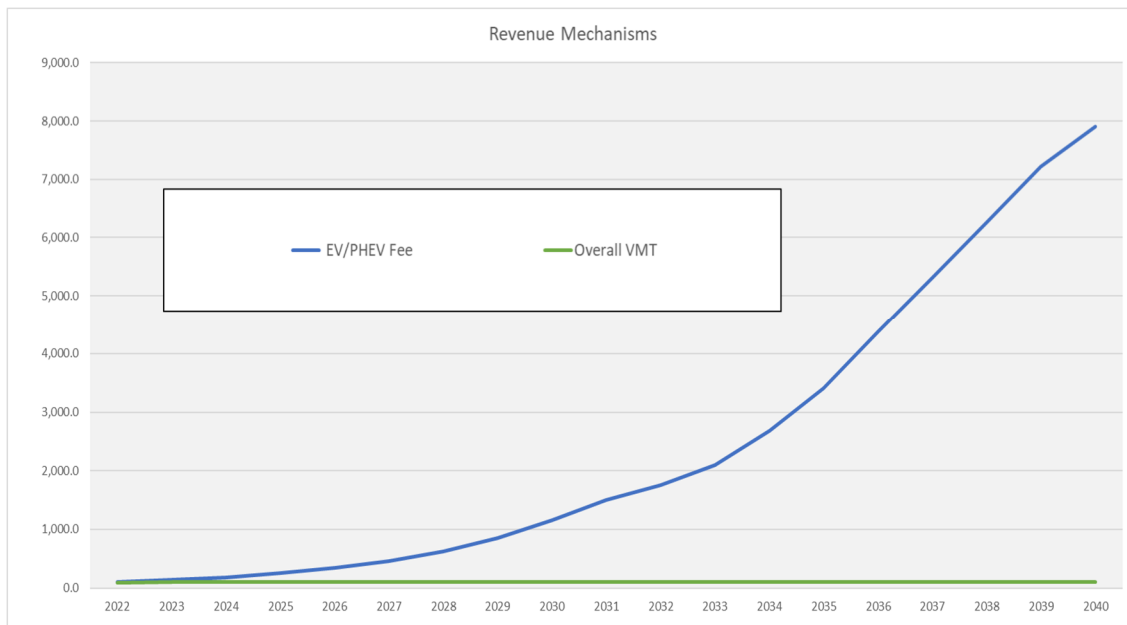
2022-2040 NPV \$3,403,000,000

Sustainability Revenue declines after 2033 due to declining numbers of internal combustion engine vehicles. Continues to be higher than VMT increase by 2050.



Electric vehicle/PHEV fee

Description	Annual registration surcharge on electric vehicles
Revenue formula	Surcharge x Number of EV/PHEVs
Key assumptions	<p>\$200 EV/PHEV</p> <p>32,300 EV/PHEV in Ohio in 2021</p> <p>Future trends based off BNEF projections (50% of light duty electric in 2050)</p>
Revenue potential	<p>2025 \$22,000,000</p> <p>2040 \$694,000,000</p> <p>2022-2040 NPV \$2,284,000,000</p>
Sustainability	Revenue increases much faster than roadway usage due to fleet electrification



Vehicle age fee

Description

Age-based registration fee involves creating a schedule of fees that varies by vehicle age, with older vehicles paying less than newer vehicles

Revenue formula

Fee x Number of vehicles (in each bracket)

Key assumptions

Fee by age class - 5 brackets

\$10 for 20+ years old

\$20 for 15-20 years old

\$30 for 10-15 years old

\$40 for 5-10 years old

\$50 for less than 5 years old

Revenue potential

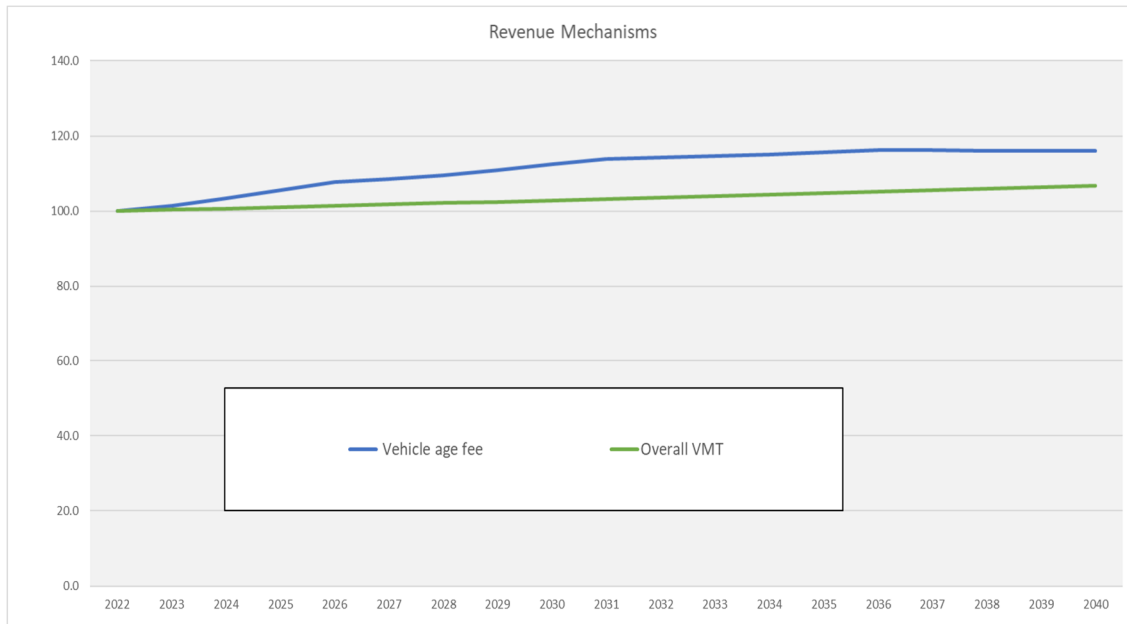
2025 \$413,000,000

2040 \$454,000,000

2022-2040 NPV \$5,661,000,000

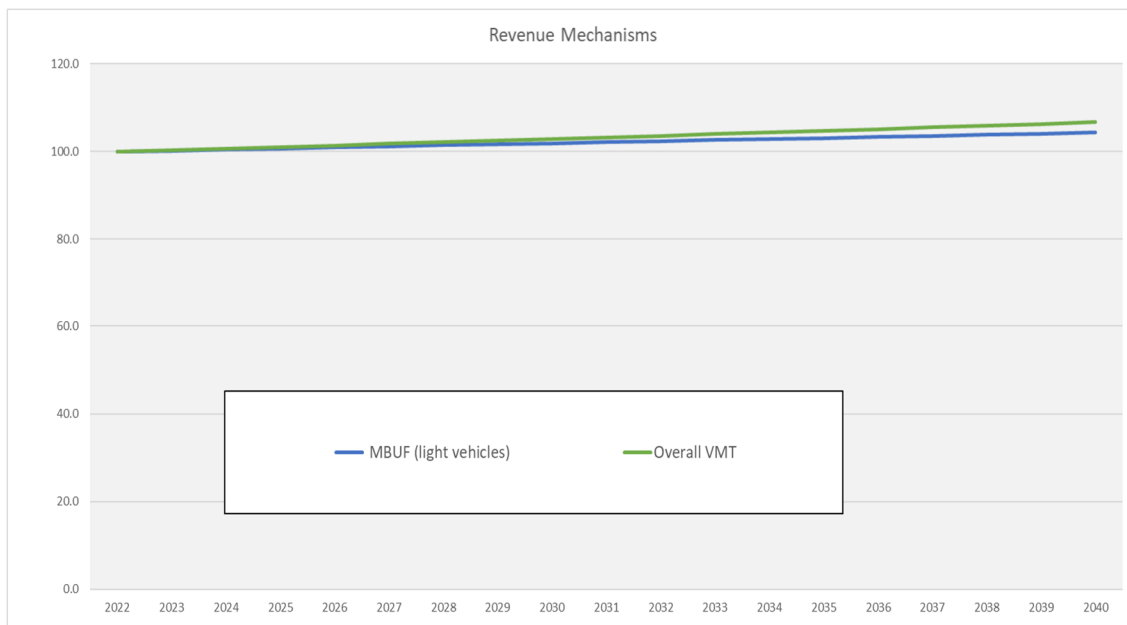
Sustainability

Revenue increases relative to roadway usage reaching 9% more in 2040



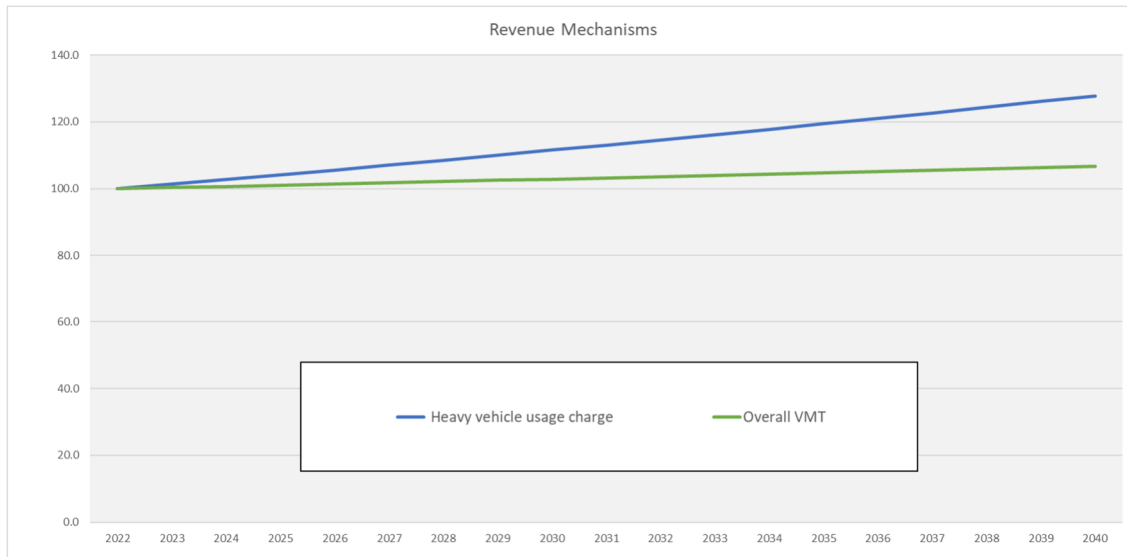
Mileage based user fee (light-duty vehicles)

Description	Fee based on distance traveled on the road network by light-duty vehicles.
Revenue formula	Rate x Light-duty VMT
Key assumptions	1.6 cents per mile. Equivalent to what the average Ohio light-vehicle driver currently pays in gas tax. This rate per mile is just an assumption for purposes of this analysis. On average, passenger cars in Ohio are rated at 23.7 MPG
Revenue potential	
	2025 \$1,674,000,000
	2040 \$1,735,000,000
	2022-2040 NPV \$22,244,000,000
Sustainability	Revenue on pace with roadway usage, a bit lower since heavy-duty vehicle VMT is expected to outpace light-duty vehicle VMT



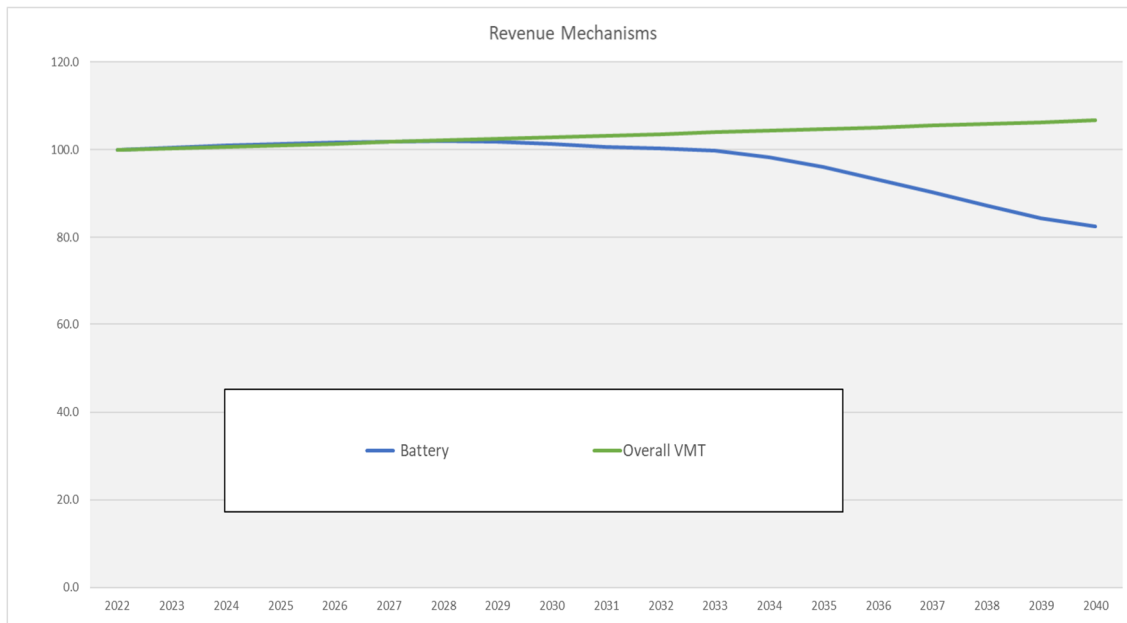
Heavy vehicle usage charge

Description	Fee based on distance traveled on the road network by heavy-duty vehicles.
Revenue formula	Rate x Heavy-duty VMT
Key assumptions	6.4 cents per mile tax is equivalent to what the average heavy vehicle pays in diesel tax (7.3 MPG). This rate per mile is just an assumption for purposes of this analysis.
Revenue potential	
	2025 \$759,000,000
	2040 \$931,000,000
	2022-2040 NPV \$10,679,000,000
Sustainability	Revenue increases faster than roadway usage since heavy-duty vehicle VMT is expected to outpace light-duty vehicle VMT



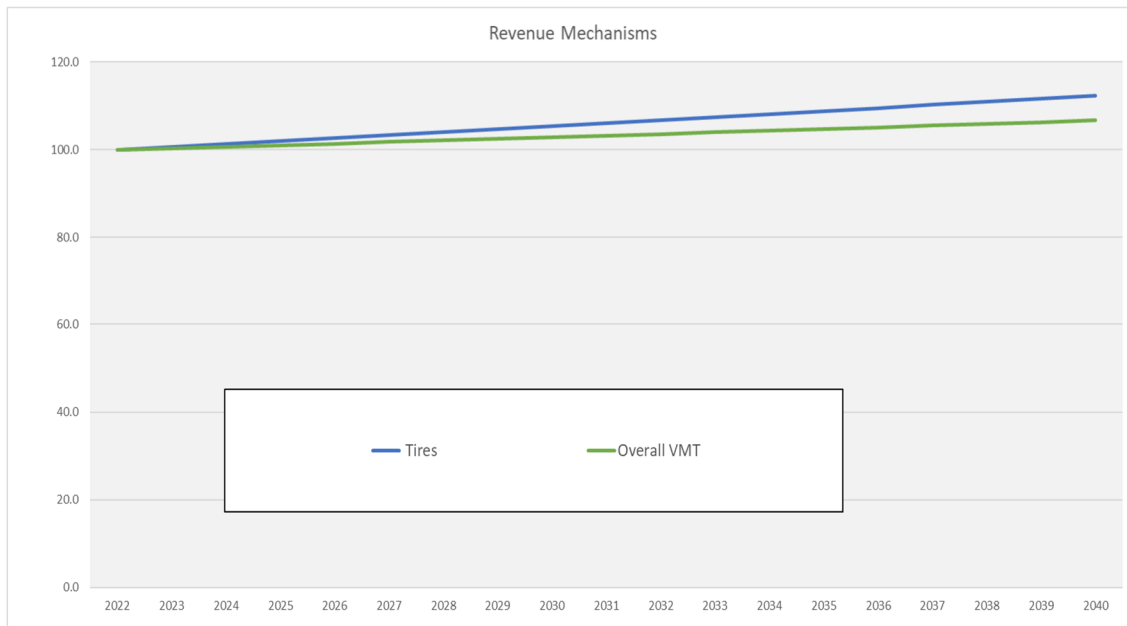
Battery fee

Description	Fee on batteries for light-duty internal combustion engine vehicles
Revenue formula	Fee x Light-duty internal combustion engine vehicles
Key assumptions	\$2 per battery
Revenue potential	
	2025 \$23,000,000
	2040 \$19,000,000
	2022-2040 NPV \$294,000,000
Sustainability	Revenue on pace with roadway usage until 2029, then declines reaching 24% less in 2040 due to fleet electrification



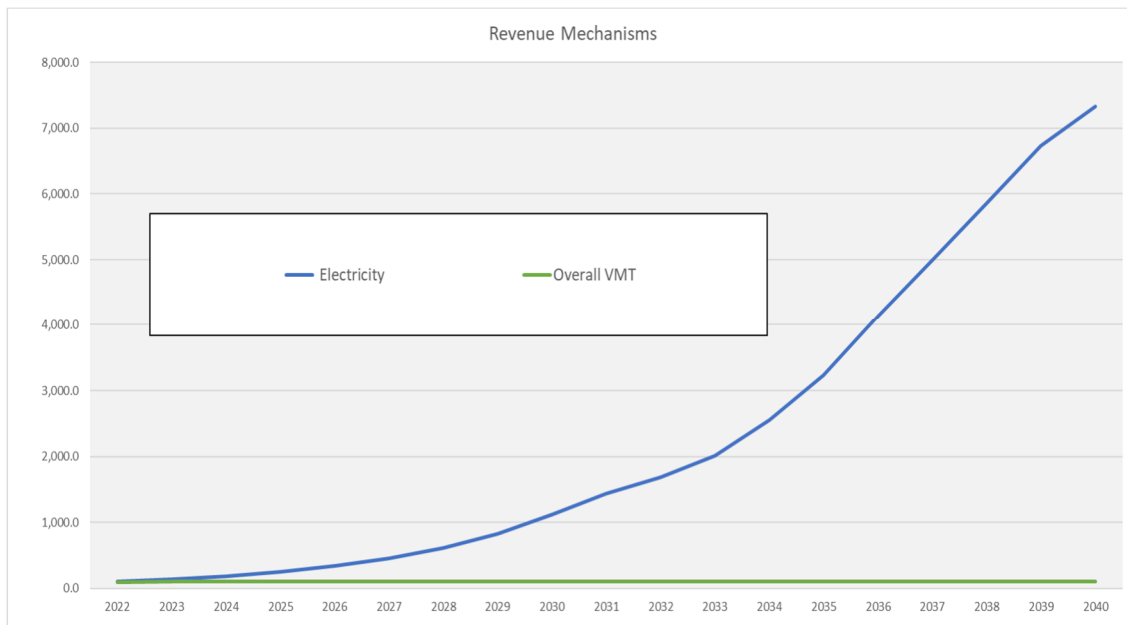
Tire fee

Description	Fee on new tires for light-duty vehicles
Revenue formula	Fee x 4 x Light-duty vehicles ÷ 5
Key assumptions	\$5 per tire Tires replaced every 5 years
Revenue potential	
	2025 \$47,000,000
	2040 \$52,000,000
	2022-2040 NPV \$634,000,000
Sustainability	Revenue on pace with roadway usage



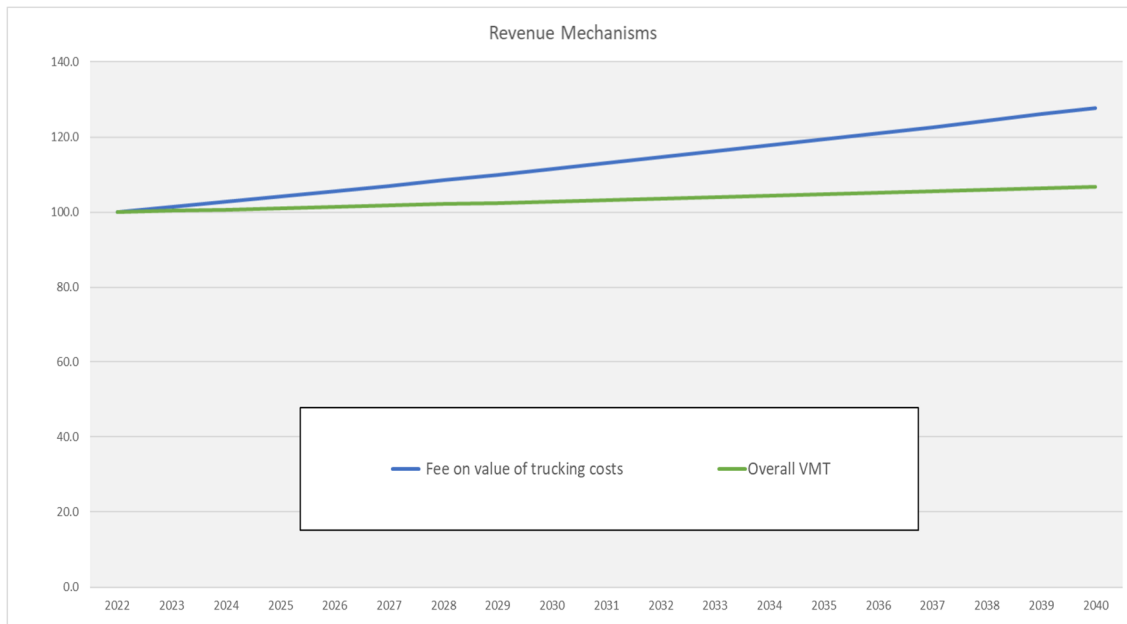
Electricity tax

Description	Tax on electricity consumed by electric vehicles
Revenue formula	Tax rate x EV VMT x electricity consumed per mile
Key assumptions	<p>\$0.02 per kWh tax rate</p> <p>30 kWh for 100 miles.</p> <p>EV miles driven based on BNEF projections</p> <p>Tax applied to EVs only</p>
Revenue potential	<p>2025 \$6,000,000</p> <p>2040 \$172,000,000</p> <p>2022-2040 NPV \$577,000,000</p>
Sustainability	Revenue increases much faster than roadway usage due to fleet electrification



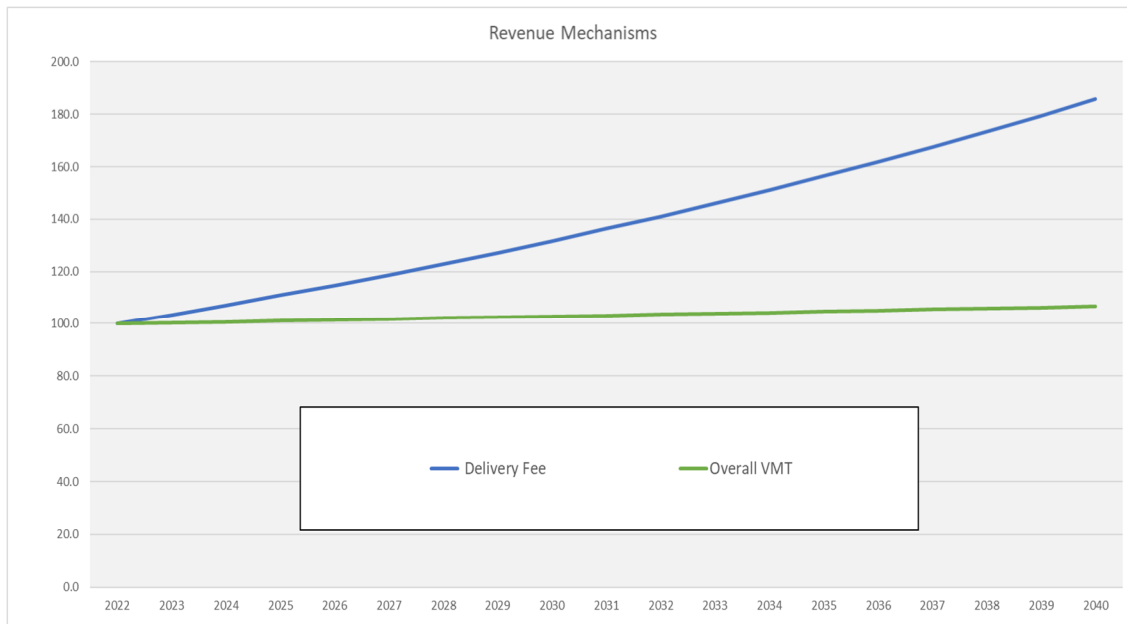
Fee on value of trucking costs

Description	Add a surcharge on goods movements as a function of the cost of moving those goods. Effectively this mechanism represents a Value Added Tax on transportation.
Revenue formula	Tax rate x Annual heavy duty VMT x Per mile fee for flatbed trucking
Key assumptions	1% tax rate \$3.07 per mile fee for flatbed trucking
Revenue potential	<p>2025 \$364,000,000</p> <p>2040 \$446,000,000</p> <p>2022-2040 NPV \$5,114,000,000</p>
Sustainability	Revenue increases faster than roadway usage due to faster pace of heavy-duty VMT



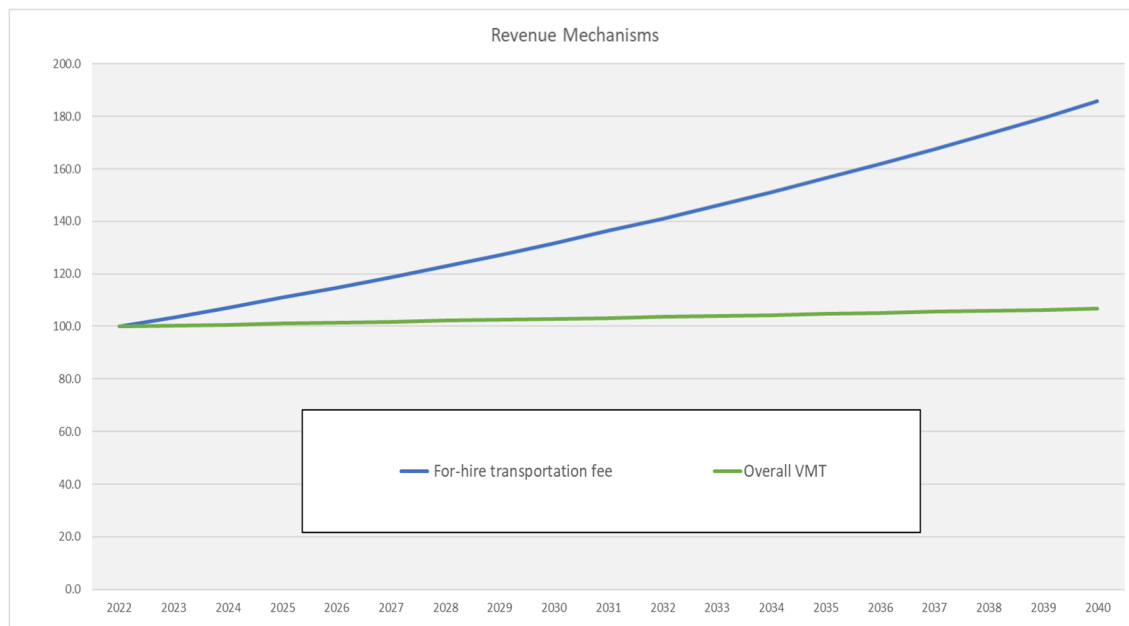
Delivery fee on tangible goods

Description	Add a fee on delivered tangible goods
Revenue formula	Rate per delivered item x Number of deliveries
Key assumptions	<p>\$0.50 per delivered tangible good package</p> <p>Number of packages delivered estimated based on Colorado data, and scaled to Ohio population</p> <p>3.5% annual growth</p>
Revenue potential	
	2025 \$306,000,000
	2040 \$512,000,000
	2022-2040 NPV \$4,822,000,000
Sustainability	Revenue increases relative to roadway usage



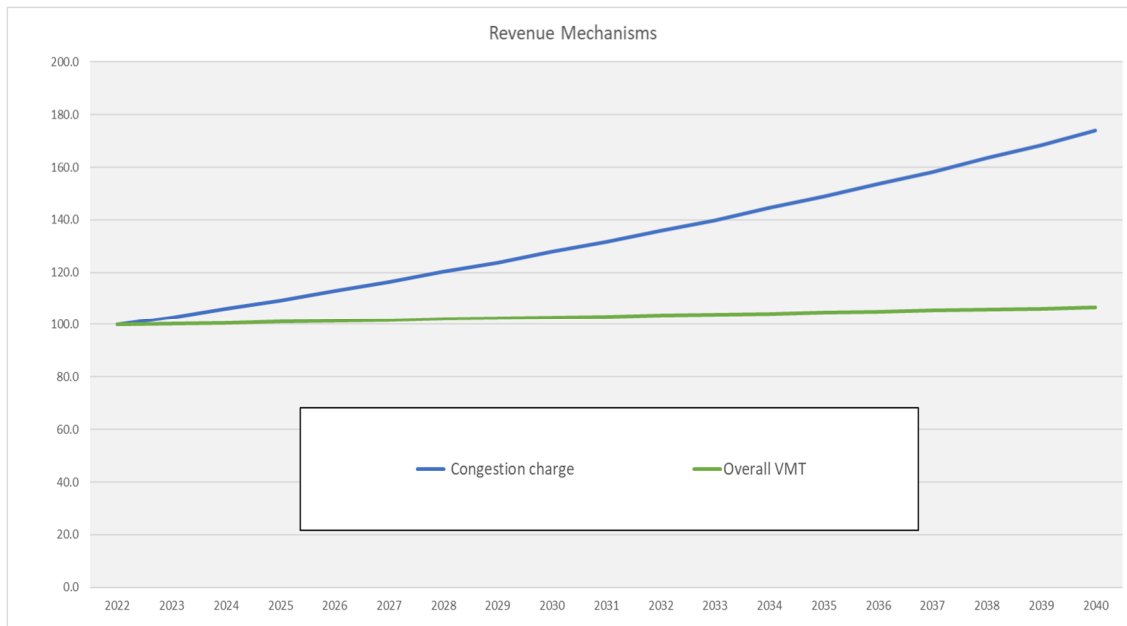
For-hire transportation fee

Description	Excise tax on the value of all for-hire ride services including traditional taxis as well as transportation network companies such as Uber and Lyft.
Revenue formula	Per-ride excise tax x Number of rides
Key assumptions	<p>\$0.30 per ride</p> <p>Number of rides estimated based on Colorado data and scaled to Ohio population</p> <p>3.5% annual growth</p>
Revenue potential	<p>2025 \$23,000,000</p> <p>2040 \$38,000,000</p> <p>2022-2040 NPV \$358,000,000</p>
Sustainability	Revenue increases relative to roadway usage



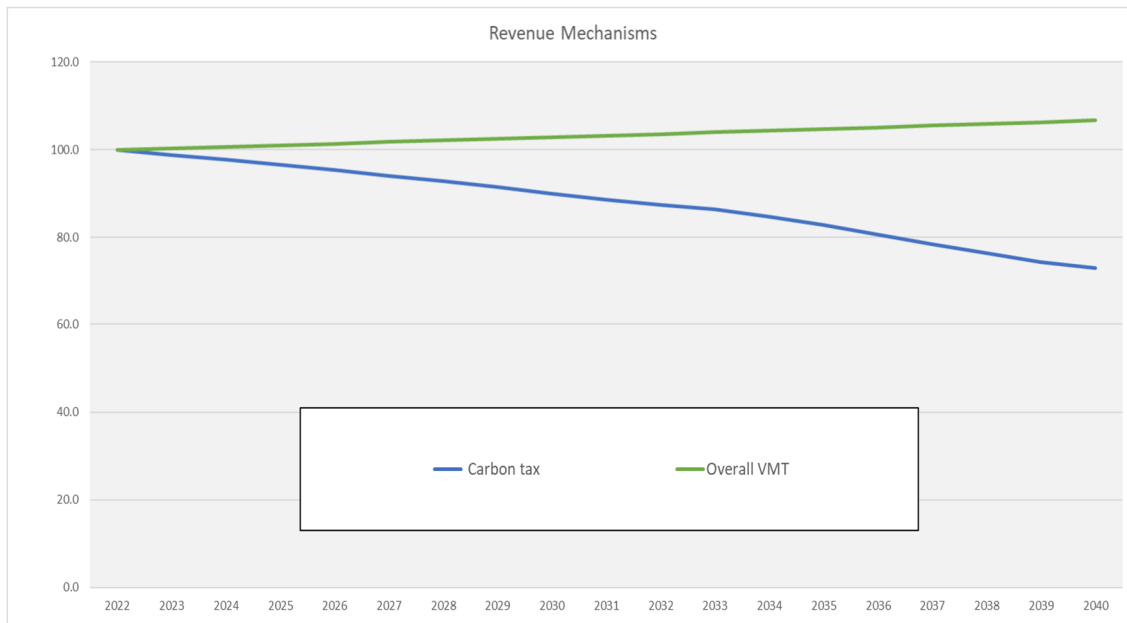
Congestion charge

Description	Fee for traveling during congested periods
Revenue formula	Annual delay x Mean Ohio wage x Value of travel time savings ÷ 5
Key assumptions	\$25.56 mean hourly Ohio wage (BLS, May 2021) 2.93% avg annual wage increase (SSA) 50% Value of Travel Time savings (US DOT) 20% of drivers assumed to divert
Revenue potential	
	2025 \$545,000,000
	2040 \$865,000,000
	2022-2040 NPV \$8,421,000,000
Sustainability	Revenue increases relative to roadway usage



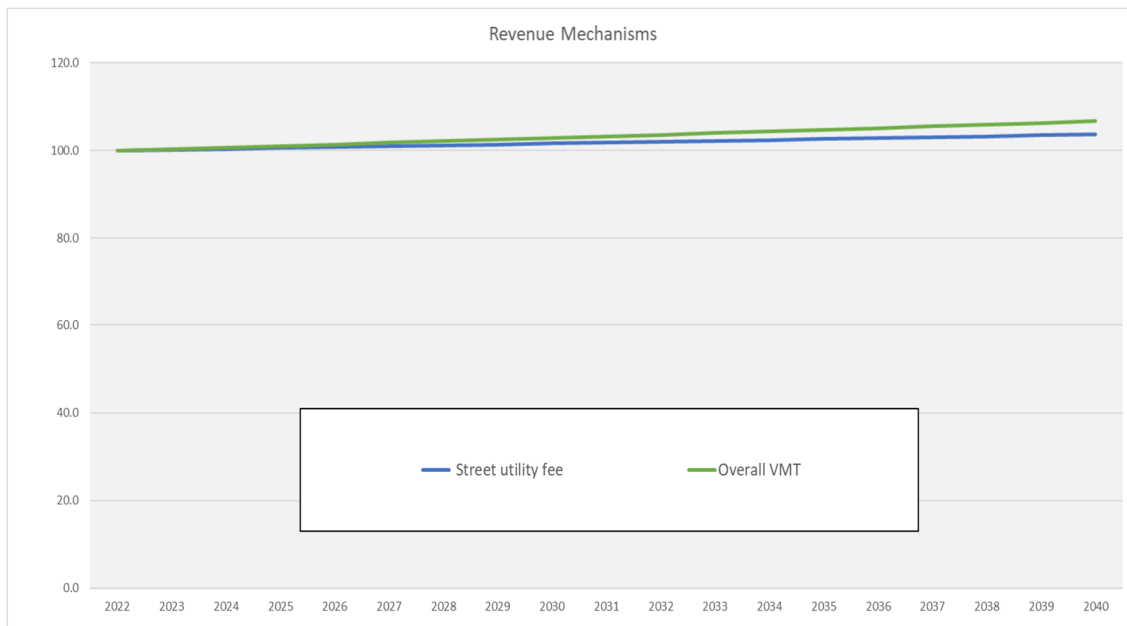
Carbon tax

Description	Assessing a fee on each ton of carbon dioxide emitted
Revenue formula	Tax rate per gallon x Gross taxable gasoline gallons
Key assumptions	\$0.15 per gallon
Revenue potential	
	2025 \$810,000,000
	2040 \$614,000,000
	2022-2040 NPV \$9,880,000,000
Sustainability	Revenue declines relative to roadway usage reaching 34% less in 2040 due to improvements in fuel economy and increasing electrification



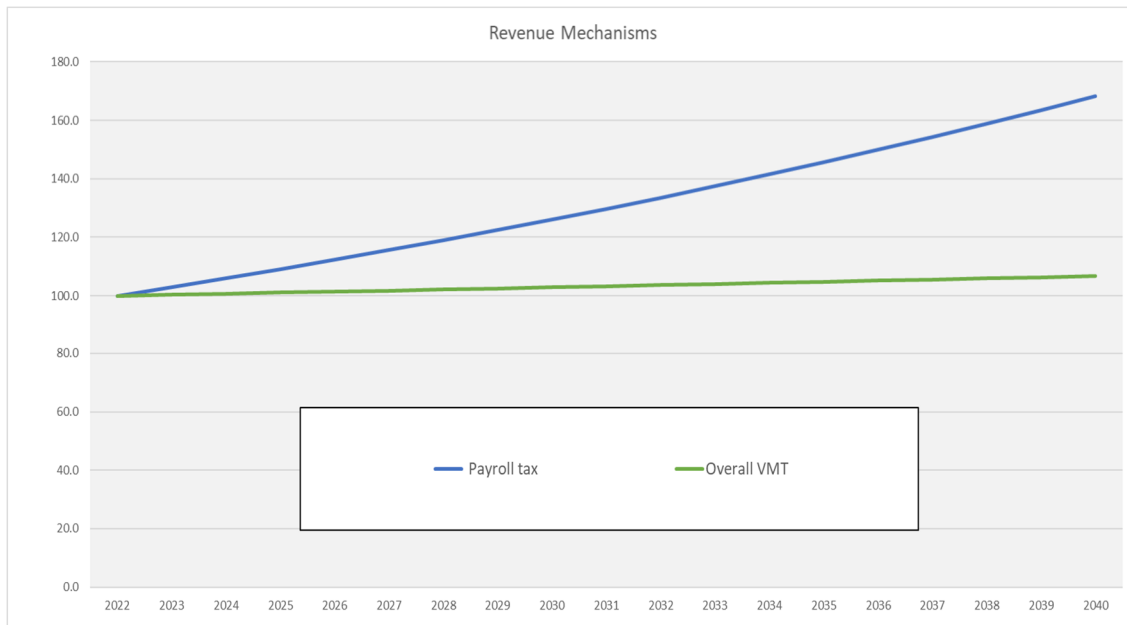
Street utility fee

Description	Statewide surcharge on residents and businesses based on the estimated road usage impacts of the property type.
Revenue formula	Fee per household x Number of households in Ohio
Key assumptions	\$30 fee per household 4.68 M households in Ohio (2015-2019) 0.2% annual growth
Revenue potential	<div> <div>2025</div> <div>\$142,000,000</div> </div> <div> <div>2040</div> <div>\$146,000,000</div> </div> <div> <div>2022-2040 NPV</div> <div>\$1,883,000,000</div> </div>
Sustainability	Revenue declines slightly relative to roadway usage



Payroll tax

Description	A statewide payroll tax would collect payments from employers as a function of wages paid
Revenue formula	Payroll tax rate x March 2021 Employment x Average weekly wage x 52
Key assumptions	Employment, average wage from BLS 0.1% payroll tax rate 2.93% avg annual wage increase (SSA)
Revenue potential	<p>2025 \$339,000,000</p> <p>2040 \$523,000,000</p> <p>2022-2040 NPV \$5,183,000,000</p>
Sustainability	Revenue increases faster than roadway usage



Land use impact fee

Description A land use impact fee is imposed on developers based on the expected impacts of development on the transportation system. To approximate the performance of such a revenue mechanism, a statewide tax was assumed as a percentage of the value of total new home sales and new commercial construction

Revenue formula $\text{Tax rate} \times \text{Average home sale values} \times \text{New home sales} + \text{Ratio of construction spending of residential to commercial} \times \text{Tax rate}$

Key assumptions

- 2022 home sales and new home sales from Ohio Realtors
- Ratio of construction to residential spending from Census data
- 5% residential tax rate
- 10% commercial tax rate
- 1% annual growth rate

Revenue potential

2025 \$224,000,000

2040 \$260,000,000

2022-2040 NPV \$3,090,000,000

Sustainability Revenue increases faster than roadway usage

