



Motor Fuel Taxes And Reformulated Gasoline In Kentucky

Research Report No. 446

Program Review And Investigations Committee

Motor Fuel Taxes And Reformulated Gasoline In Kentucky

Program Review and Investigations Committee

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Abstract

Kentucky's current motor fuels taxes per gallon are 26 cents for gasoline and 23 cents for diesel. The largest component is the motor fuel excise tax, currently 19.6 cents, which is set to 9 percent of the average wholesale price of gasoline (AWP). AWP is determined through quarterly surveys of fuel suppliers, but the value of AWP used to set the tax rate is limited by a statutory minimum and maximum. HB 299, enacted in 2015, allowed the excise tax rate to fall but not as much as it would have. Kentucky's gasoline tax is slightly more than 1 cent per gallon below the US average and less than 1 cent below the average of surrounding states. Kentucky's diesel tax is 5 cents per gallon below the US average and 3.55 cents below the surrounding states' average. Growth in state motor fuels tax revenues has slowed, partly due to drivers traveling fewer miles. Kentucky requires that only reformulated gasoline (RFG), which is designed to produce fewer emissions, be sold in certain areas of the state to help meet ozone standards set by the Environmental Protection Agency. Research has found that ozone aggravates the functioning of the heart and lungs, especially for the elderly, children, and those with respiratory issues. Nationally, RFG costs approximately 18 cents more per gallon than conventional gasoline. The additional cost in Kentucky is uncertain.

Foreword

The Legislative Research Commission was established in 1948 to provide the staffing essential to the smooth and efficient operation of the Kentucky General Assembly. Over the course of the last 70 years, this organization has evolved into today's LRC: a multifaceted organization filling the many needs of a modern state legislature. As Kentuckians, we are fortunate to have hundreds of knowledgeable and dedicated professionals who provide high levels of analysis, legislative support, and customer service.

The staff of the Program Review and Investigations Committee perform the important work of monitoring and evaluating governmental programs throughout the commonwealth. At the direction of the committee, they undertake a number of Research Reports every year, focusing on specific, well-defined questions of public policy.

Thank you for your interest in this publication, and thank you to everyone who made this report possible.



David A. Byerman
Director

Legislative Research Commission
Frankfort, Kentucky
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Summary

Kentucky's Motor Fuel Tax

Currently, Kentucky motor fuel taxes are 26 cents per gallon for gasoline and 23 cents for diesel. Each tax consists of the motor fuels excise tax (19.6 cents), the supplemental highway user motor fuel tax (5 cents for gasoline and 3 cents for diesel), and the petroleum storage tank environmental assessment fee (1.4 cents). The motor fuels excise tax is 9 percent of the average wholesale price (AWP) of gasoline. The Department of Revenue surveys fuel wholesalers quarterly to determine the AWP. However, statutes set limits on the minimum and maximum values that may be used to set the motor fuels excise tax rate.

HB 299, enacted in 2015, changed how the motor fuels excise tax rate is set. Previously, the excise tax rate was set quarterly. The minimum AWP was \$1.786, which resulted in a minimum excise tax rate of 16.1 cents per gallon. The maximum AWP was 110 percent of the AWP at the end of the previous fiscal year. This maximum limited increases in the excise tax rate to 10 percent per year.

HB 299

- increased the minimum AWP from \$1.786 to \$2.177 per gallon;
- set the AWP at \$2.177 for FY 2016;
- established an annual adjustment for the AWP based on the previous four quarters, starting with FY 2017; and
- limited annual changes in the AWP to 10 percent.

HB 299 effectively set the motor fuels excise tax rate at 19.6 cents per gallon for the fourth quarter of FY 2015 and all of FY 2016. HB 299 allowed the excise tax rate to decrease but not as much as it would have if HB 299 had not passed.

Kentucky's motor fuels tax receipts are tied to the tax rate and taxable gallons. Taxable gallons increased in the 1990s, but growth in taxable gallons has tapered off since the 2007-2009 recession. Over the past two decades, annual taxable gallons have averaged 3.17 billion.

Increases in Kentucky's motor fuels tax receipts have been attributable to increases in the motor fuels excise tax rate since FY 2005. Prior to FY 2005, increases in motor fuels tax receipts were largely driven by increases in taxable gallons.

As motor fuels tax receipts have grown, the motor fuels tax has become more important to the road fund. The other major contributor to the road fund is the motor vehicle usage tax. These two taxes now constitute 84 percent of the road fund. After certain deductions are taken, local governments receive 48.2 percent of motor fuels tax receipts.

In 19 states, including Kentucky, the motor fuels tax rate per gallon varies with the price of gasoline. The other states have a fixed motor fuels tax rate per gallon. Most variable-rate states link their motor fuels tax to changes in the price of fuel. Recently, six states tied changes in their motor fuels tax rate to changes in the consumer price index. On average, states with variable

rates have higher motor fuel tax rates than those with fixed rates, primarily because tax rates in variable-rate states increase with gas prices.

Since 2013, 13 states have increased their motor fuels tax. As a result, state average motor fuels tax rates increased in the last few years. The average increase for these 13 states was 6 cents per gallon for gasoline and 5.3 cents per gallon for diesel.

Kentucky's gasoline tax is slightly more than 1 cent per gallon below the US average and is the 28th highest in the nation. Kentucky's gasoline tax is slightly lower than the surrounding states' average. Kentucky's diesel tax is 5 cents per gallon below the US average and 3.55 cents below the surrounding states' average.

States have faced challenges meeting their transportation needs because of higher construction costs and weakening growth in motor fuels tax receipts. Weak growth in motor fuels tax receipts nationally is largely due to inconsistent growth in taxable gallons sold. Declines in vehicle miles traveled and increases in fuel efficiency have dampened the growth in taxable gallons.

Changes in vehicle purchases also affect taxable gallons and motor fuels tax receipts. Sales of electric vehicles are growing but still account for less than 1 percent of sales. Nearly one-half of electric cars in the US are in California.

The decline in vehicle miles traveled and increases in fuel efficiency have led states to consider moving away from a gallon tax to a mileage tax. Oregon has conducted pilot programs of a mileage-based tax. In 2013, the legislature created a road usage charge based on miles driven. The program began on July 1, 2015, and is limited to 5,000 volunteers.

Reformulated Gasoline

Ground-level ozone forms when pollutants in gasoline emissions combine and is a hazard to human health and the environment. The Clean Air Act gives the Environmental Protection Agency authority to set standards for ozone concentrations. States must create State Implementation Plans (SIPs) that outline the policies that will be implemented in order to meet and maintain these standards. One of the possible policies is a requirement that states or parts of states sell only reformulated gasoline (RFG), which undergoes additional processing to reduce pollutants in its emissions.

In 1995, Louisville and Northern Kentucky were enrolled in the RFG program because of their high levels of ozone. The policies in Kentucky's SIP have enabled the state to lower ozone levels significantly, with the RFG program responsible for a large proportion of these reductions. The reduction in ozone likely saves lives of Kentuckians as ozone exposure causes respiratory and cardiopulmonary complications and is shown to increase mortality. These effects are especially pronounced in the children and elderly. Because of the Clean Air Act's anti-backsliding provision, any elimination of the RFG program must be met with the implementation of new policies that achieve equivalent reductions in pollutants.

Nationally, RFG costs approximately 18 cents more per gallon than conventional gasoline. RFG also decreases fuel efficiency by approximately 1 percent to 2 percent.

Chapter 1

Introduction

At its December 2014 meeting, the Program Review and Investigations Committee directed staff to study Kentucky's motor fuels taxes and reformulated gasoline.

Kentucky's motor fuels tax per gallon consists of the 1.4-cent petroleum storage tank environmental assessment fee, the 5-cent supplemental highway user motor fuel tax for gasoline, the 2-cent supplemental highway user motor fuel tax for diesel, and the motor fuels excise tax, which is 9 percent of the average wholesale price of gasoline.

Kentucky's motor fuels tax has three components. The petroleum storage tank environmental assessment fee is 1.4 cents per gallon of motor fuel. The supplemental highway user motor fuel tax is 5 cents per gallon for gasoline and 2 cents per gallon for special fuels, which consist primarily of diesel. The motor fuels excise tax is 9 percent of the average wholesale price (AWP) per gallon of gasoline. The Department of Revenue determines the AWP through surveys sent to fuel wholesalers. Regardless of the value of the AWP determined through the survey, statutes set minimum and maximum values of the AWP the department may use when setting the rate. The limits on the AWP also limit the tax rates that may be levied. HB 299, enacted in 2015, made changes to how the motor fuels excise tax rate is set.

States face rising transportation construction costs and slower growth in motor fuel tax revenues. Several trends are frequently cited as contributing to the slower revenue growth, including increased fuel efficiency of vehicles, adoption of electric vehicles, and slow growth in the number of miles driven.

Reformulated gasoline (RFG) reduces emissions that contribute to ozone. Kentucky requires that only RFG be sold in certain areas of the state.

When gasoline is burned, it emits pollutants that contribute to ground-level ozone. Research has found that ozone contributes to a number of respiratory health issues. Reformulated gasoline (RFG) is designed to emit less air pollution than regular gasoline. The Clean Air Act requires gas retailers in areas that are in severe violation of air quality standards to sell only RFG. The Clean Air Act also allowed each state's governor to extend the requirement to other areas of the state that have poor air quality. Although not required under the Clean Air Act, Kentucky opted to restrict gasoline sales to RFG in Boone, Campbell, Jefferson, and Kenton Counties and parts of Bullitt and Oldham Counties because of the high levels of air pollutants.

Major Conclusions

This report has eight major conclusions.

This report has eight major conclusions.

- Kentucky's motor fuels excise tax, which can vary based on average wholesale price, did not change from 1980 to 2005.
- Increases in gas prices from 2005 to 2014 increased Kentucky's motor fuels tax rate and contributed to growth in tax revenue.
- Decreases in average wholesale price during FY 2015 resulted in decreases in Kentucky's tax rate. HB 299 allowed the tax rate to fall but prevented it from falling as much as it would had the bill not been enacted.
- Kentucky's motor fuels tax rates are lower than those of surrounding states and the average rate for all states.
- Declining vehicle miles traveled and improvements in fuel efficiency have limited growth in motor fuel tax rates.
- The RFG program in Kentucky has helped the state comply with federal ozone standards by decreasing emissions that contribute to ozone. Ozone aggravates respiratory and cardiopulmonary functioning, and empirical evidence suggests that death rates increase when ozone concentrations rise.
- If Kentucky no longer required RFG, the state would have to adopt other policies that would yield similar emissions reductions.
- Nationally, RFG costs approximately 18 cents more per gallon than conventional gasoline. The additional cost for RFG in Kentucky is uncertain.

Chapter 2

Motor Fuel Taxes And Fees

Under the Federal Aid Road Act of 1916 and the Federal Highway Act of 1921, the federal government provided matching funds to states for road construction.

For nearly a century, gasoline taxes have played a role in funding road improvements in the United States. The Federal Aid Road Act of 1916 and the Federal Highway Act of 1921 provided the initial impetus for states to increase their commitment to improving roads by providing matching funds to the states for road construction.¹

The gasoline excise tax was the primary revenue source used by states to match federal road aid funds. This excise tax was a volume tax in which the rate was levied per gallon—a taxing approach that is still prevalent among states.

States adopted gasoline excise taxes to generate the funds need to provide the states' match.

Oregon passed the first gasoline tax in 1919 (1 cent per gallon) and was soon followed by Colorado, New Mexico, and North Dakota. By 1929, all 48 states had adopted a gasoline excise tax. In 47 states, the initial tax rate was 1 or 2 cents per gallon; Virginia's initial rate was 3 cents per gallon.²

Motor Fuel Taxation In Kentucky

Kentucky's motor fuel taxes and fees consist of the motor fuels excise tax, the petroleum storage tank environmental assessment fee, and the supplemental highway user motor fuel tax.

Since 1990, the three components of Kentucky's motor fuel tax are

- the motor fuels excise tax,
- the petroleum storage tank environmental assessment fee, and
- the supplemental highway user motor fuel tax.

These three components constitute the per-gallon motor fuels tax rate paid by wholesalers on fuel sales. The federal motor fuel tax (18.4 cents per gallon for gasoline and 24.4 cents per gallon for diesel) is in addition to the state motor fuel tax.

The motor fuels excise tax is 9 percent of the average wholesale price (AWP) per gallon of gasoline. There are restrictions on the value of the AWP that may be used to set the tax rate.

The motor fuels excise tax applies to gasoline and special fuels and is often called the variable portion of Kentucky's motor fuels tax. Currently, the excise tax is 9 percent of the average wholesale price per gallon of gasoline with restrictions on the values of the AWP that may be used to set the rate.

The petroleum storage tank environmental assessment fee is 1.4 cents per gallon.

The petroleum storage tank environmental assessment fee is fixed at 1.4 cents per gallon. Proceeds go to the underground storage tank fund rather than to the road fund.

The supplemental highway user motor fuel tax is 5 cents per gallon for gasoline and 2 cents per gallon for special fuels. This tax is often called the fixed portion of Kentucky's motor fuel tax.

This section briefly discusses the history of Kentucky's motor fuel taxes and fees. The most recent change to the motor fuel tax resulted from the passage of HB 299 by the 2015 General Assembly.

1920 To 1979: Establishment Of Kentucky's Motor Fuels Excise Tax

Kentucky's motor fuel tax was enacted in 1920. The tax was 1 cent per gallon.

Kentucky was the fifth state to levy a gasoline excise tax, enacting a 1 cent per gallon tax in 1920.^a The enabling legislation stipulated that gasoline tax receipts were to be used for the construction and maintenance of state highways and were to be kept separate in the State Treasury and credited to the road fund. By 1926, Kentucky's gasoline tax rate was 5 cents per gallon, making it one of the three highest in the US.³

In 1945, Kentucky amended its constitution to require that revenue from the motor fuels excise tax be used to construct, maintain, and repair public highways.

In 1945, Section 230 of the Constitution of Kentucky was amended to restrict the purposes for which road fund receipts could be used. The amendment restricted receipts from the gasoline excise tax, and licenses and fees on motor vehicles, to the construction, maintenance, and repair of public highways, including administrative costs and expenses associated with enforcing state traffic and motor vehicle laws.

In 1948, Kentucky's gasoline excise tax rate increased from 5 cents to 7 cents per gallon. The 1948 legislation dedicated 2 cents per gallon of the tax to improving rural and secondary roads.

As advanced technology and improved roads led to growth in the trucking industry, the use of other types of fuels became more prevalent. These other types of fuels were defined as special fuels. Most fuel used in this category was diesel. In 1952, Kentucky broadened the fuel tax base to include special fuels, imposing the 7 cents per gallon tax rate that applied to gasoline. Gasoline and special fuels excise taxes became known as motor fuel taxes.^b

^a Appendix A summarizes the major legislative changes pertaining to Kentucky's motor fuel tax.

^b The focus of this report is the excise and supplemental highway user tax on motor fuels. In addition to these two taxes, there is a surtax imposed on heavy equipment motor carriers.

Kentucky's motor fuels excise tax rate remained at 7 cents until 1972, when it increased to 9 cents per gallon. That rate prevailed until 1980.

1980 To 2004: Transition To A Variable-Rate Motor Fuels Excise Tax

The 1980 General Assembly amended the motor fuels excise tax. The tax rate was set at 9 percent of the AWP.

HB 973, enacted in 1980, made significant revisions to Kentucky's motor fuels excise tax. The tax was amended to allow the per-gallon tax rate to vary according to changes in the AWP of gasoline. The motor fuels excise tax was set at 9 percent of the AWP per gallon, allowing the tax rate to vary with prices.

The AWP was determined through a survey of fuel dealers. Statutes set minimum and maximum values of the AWP that could be used to set the tax rate. These limits on the AWP effectively limited the excise tax rate that could be levied.

The AWP of gasoline and the excise tax would be determined each quarter based on a survey of fuel dealers. Statutes set minimum and maximum values for the AWP that could be used in calculating the tax rate, which effectively established a minimum and a maximum motor fuels excise tax rate.

The AWP floor was initially set at \$1.00 per gallon in 1980; therefore, the minimum excise tax rate was 9 cents per gallon (9 percent \times \$1.00). HB 478, enacted in 1982, raised the AWP floor to \$1.11 per gallon, which increased the minimum motor fuels excise tax rate to 10 cents per gallon.

The maximum AWP was \$1.50 per gallon in FY 1981 and FY 1982; therefore, the maximum excise tax for these fiscal years was 13.5 cents per gallon. After FY 1982, the \$1.50-per-gallon AWP ceiling no longer applied. Annual increases in the AWP were limited to 10 percent of the AWP used to calculate the tax rate at the close of the previous fiscal year. The maximum AWP and excise tax rate could increase over time but no more than 10 percent annually. The minimum AWP could change only through legislative action.

HB 126, enacted in 1986, levied an additional tax on motor fuels. The supplemental highway user motor fuel tax was initially based on a complicated comparison of the AWP from two distinct time periods. The legislation specified a maximum supplemental highway user tax of 5 cents per gallon for gasoline and 2 cents per gallon for special fuels and stipulated that the tax could not decline from one quarter to the next. The initial supplemental highway user tax resulted in the maximum tax rate for both gasoline and special fuels. These supplemental rates were eventually codified in statute at 5 cents per gallon for gasoline and 2 cents per gallon for

diesel. The supplemental tax is often called the fixed portion of Kentucky's motor fuels tax.

The 1990 General Assembly levied a petroleum storage tank environmental assessment fee of 0.4 cents per gallon. In 1995, this fee increased to 1.4 cents per gallon.

From FY 1982 to FY 2005, the variable portion of the excise tax was 10 cents per gallon.

None of the changes made to the motor fuels statutes from 1986 to 2004 led to increases or decreases in the motor fuels excise tax or supplemental highway user motor fuel tax. After the variable portion of the motor fuels excise tax increased to 10 cents per gallon in 1982, the excise tax did not change until FY 2005 because the AWP of gasoline from each quarterly survey from 1982 through 2004 was below the minimum established in statute; therefore, the excise tax rate remained at 10 cents per gallon (9 percent \times \$1.11).⁴

2005 To 2015: Growth In The Motor Fuels Excise Tax Rate

Since 1980, the motor fuels excise tax rate has been 9 percent of the AWP. The AWP used to calculate the tax rate could be the average wholesale price determined by a survey of fuel dealers, the minimum average wholesale price, or the maximum average wholesale price. The AWP, and therefore the excise tax, can change, but the changes are limited by statute.

The Department of Revenue surveys fuel dealers quarterly to determine the AWP.

The Department of Revenue surveys fuel wholesalers in January, April, July, and October to determine the AWP each quarter. The AWP of gasoline from the survey is based on the weighted-average price (based on volume) of various types (conventional and reformulated) and grades (low, mid-grade, and premium) of fuel. The AWP of gasoline is heavily weighted toward low-octane fuel since it accounts for more than 90 percent of the gasoline sold in Kentucky.⁵

Prior to the passage of HB 299, the surveyed AWP determined in the first month of each quarter was used to determine the excise tax rate charged in the following quarter. For example, the survey results from January were used to determine the excise tax rate imposed during the fourth quarter of the fiscal year, which runs from April to June. The survey schedule that was used is shown in Table 2.1.

Table 2.1
Average Wholesale Price Survey Schedule Prior To HB 299

Survey Conducted	Fiscal Quarter In Which Excise Tax Rate Is Applied
January	4 (April–June)
April	1 (July–September)
July	2 (October–December)
October	3 (January–March)

The surveyed AWP is compared to the minimum and maximum values that may be used to set the excise tax rate.

Setting The Motor Fuels Excise Tax Rate Prior To HB 299. To set the excise tax rate for a quarter, the Department of Revenue determined the AWP from the survey conducted in the first month of the previous quarter. The surveyed AWP was compared to the maximum and minimum AWP allowed for setting the excise tax rate. Three possible outcomes and the corresponding calculations of the tax rates appear in Table 2.2.

Table 2.2
Calculation Of Motor Fuels Excise Tax Rates Prior To HB 299

Average Wholesale Price Survey Results	Motor Fuels Excise Tax Rate
Surveyed AWP > Maximum AWP	Maximum AWP × 9%
Maximum AWP ≥ Surveyed AWP ≥ Minimum AWP	Surveyed AWP × 9%
Minimum AWP > Surveyed AWP	Minimum AWP × 9%

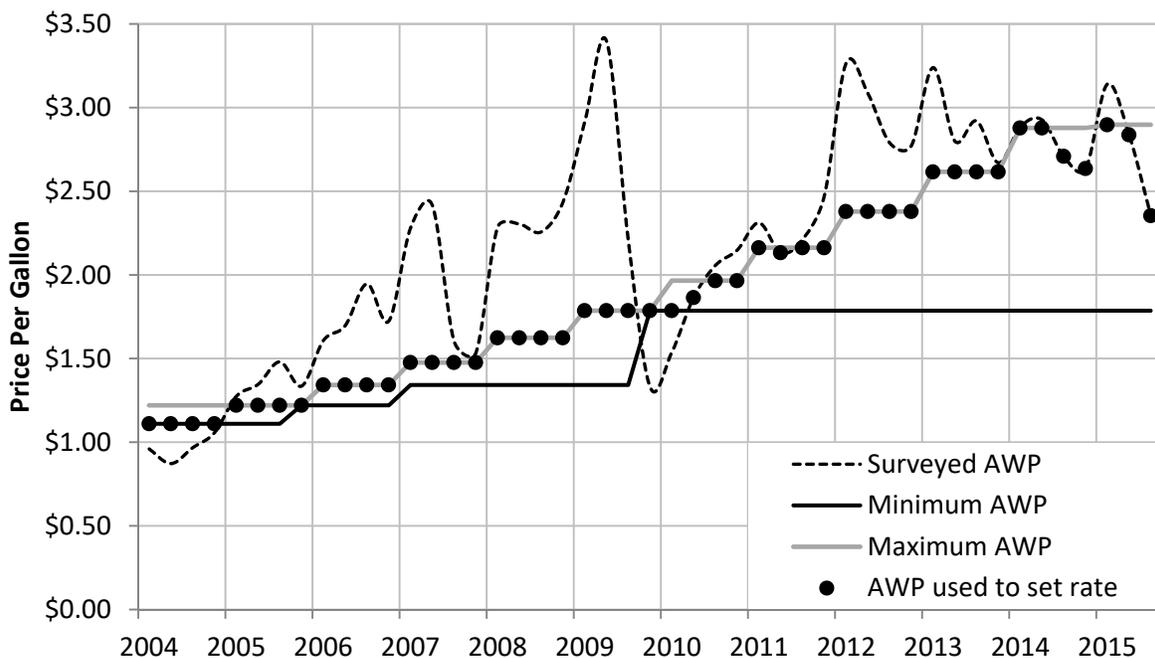
If the surveyed AWP exceeded the maximum AWP, the maximum AWP was used to set the motor fuels excise tax. In this instance, the motor fuels excise tax for the calendar quarter would be 9 percent of the maximum AWP. If the surveyed AWP was less than the maximum AWP but greater than the minimum AWP, the motor fuels excise tax would be 9 percent of the surveyed AWP. Finally, if the minimum AWP was greater than the surveyed AWP, the motor fuels excise tax would be 9 percent of the minimum AWP.

Regardless of the AWP determined by the survey, the value used as the AWP for setting the motor fuels excise tax could not exceed the maximum AWP or be less than the minimum AWP. Limiting the range of AWP values used in calculating the tax limited the excise tax rate.

The surveyed AWP has varied significantly.

Figure 2.A shows the surveyed, minimum, and maximum AWP and the value of the AWP used to set the excise tax rate from FY 2004 to the third quarter of FY 2015. The surveyed AWP rose from a low of 87 cents per gallon in the second quarter of FY 2004 to a high of \$3.40 per gallon in the second quarter of FY 2009. During FY 2009, the surveyed AWP experienced its largest drop, falling by \$2.07 to \$1.33 per gallon in the fourth quarter of FY 2009. The surveyed AWP recovered, exceeding \$3.00 in the first quarters of FY 2012, FY 2013, and FY 2015. During FY 2015, the AWP from the survey experienced consecutive declines.

Figure 2.A
Maximum, Minimum, And Surveyed Average Wholesale Price Of Gasoline
FY 2004 To Third Quarter FY 2015



Sources: Kentucky. Dept. of Revenue. Division of Miscellaneous Taxes. Gasoline Excise Tax Rate memos, various years; Kentucky. Finance and Administration Cabinet. Handout at meeting of the Budget Review Subcommittee on Transportation. Frankfort. Nov. 17, 2014.

The minimum AWP is set in statute and can change only by legislative action. The General Assembly increased the minimum AWP from \$1.11 to

- \$1.22 in FY 2005,
- \$1.342 in FY 2006, and
- \$1.786 in FY 2009.

These changes to the minimum AWP resulted in the minimum excise tax increasing from 10 cents to

- 11 cents in FY 2005,
- 12.1 cents in FY 2006, and
- 16.1 cents in FY 2009.

When the surveyed AWP was below the minimum AWP, the minimum AWP was used to set the tax rate. This occurred for each quarter in FY 2004. As a result, the AWP used to calculate the excise tax rate was \$1.11 for the year and the excise tax rate was 10 cents per gallon ($\$1.11 \times 9$ percent). The surveyed AWP also fell below the minimum in the fourth quarter of FY 2009 and the first quarter of FY 2010. In these two quarters, the minimum AWP (\$1.786) was used to set the excise tax rate at 16.1 cents.

Prior to 2015, the maximum AWP was 110 percent of the AWP at the end of the previous fiscal year.

The AWP used to calculate the motor fuels excise tax in any quarter during a fiscal year could not exceed 110 percent of the AWP at the close of the previous fiscal year. This statutory provision limited increases in the AWP and the motor fuel excise tax to no more than 10 percent. For example, in the fourth quarter of FY 2014 the AWP used to calculate the excise tax rate was \$2.634. Because of the statutory maximum, the AWP for each quarter of FY 2015 could not exceed \$2.897 ($\2.634×110 percent), and the maximum excise tax was 26.1 cents per gallon ($\$2.897 \times 9$ percent). If the surveyed AWP during any quarter of FY 2015 was higher than \$2.897, the \$2.897 maximum AWP would have been used to calculate the excise tax rate.

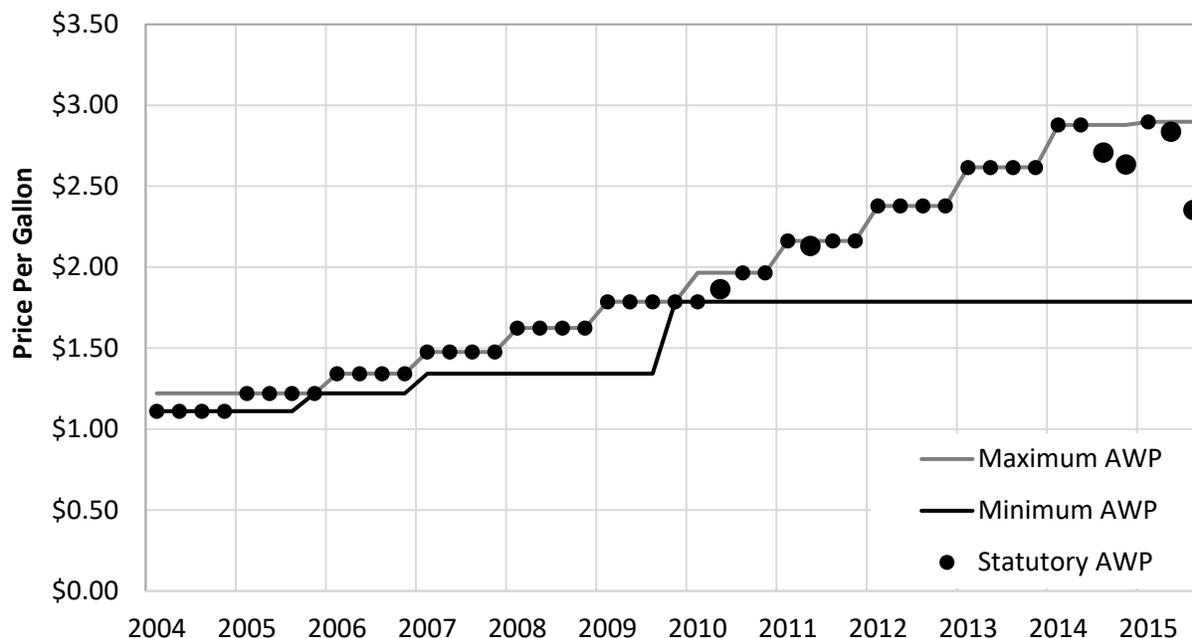
When the surveyed AWP exceeds the maximum AWP, the maximum AWP is used to set the rate.

Since FY 2004, the surveyed AWP exceeded the maximum in 36 of 47 quarters. When the surveyed AWP exceeded the maximum, two impacts occurred. First, the maximum AWP would be used to calculate the tax rate. Second, if the AWP used to establish the excise tax is equal to the maximum at the end of a fiscal year, the maximum AWP in the following year increases by the full 10 percent permitted by statute. With the exception of FY 2014, the surveyed AWP exceeded the maximum at the end of each fiscal year. This permitted the maximum AWP to increase 10 percent annually and subsequently led to the excise tax rate increasing by 10 percent in these years.

Figure 2.B shows the minimum AWP, the maximum AWP, and the AWP used to calculate the tax rate from FY 2004 to the third quarter of FY 2015. As noted, if the surveyed value is above the maximum, the maximum is used to set the rate. If the surveyed AWP is below the minimum, the minimum is used to set the rate. Finally, if the surveyed AWP falls between the minimum and the maximum, the surveyed value is used. Of the 47 quarters shown,

the minimum was used in 5 quarters, the maximum in 36, and the surveyed AWP in 6. The AWP typically increased by 10 percent from one fiscal year to the next. Changes during a fiscal year were infrequent.^c

Figure 2.B
Surveyed, Maximum, And Minimum Average Wholesale Prices
Used To Set Motor Fuels Excise Tax Rates
FY 2004 To Third Quarter FY 2015



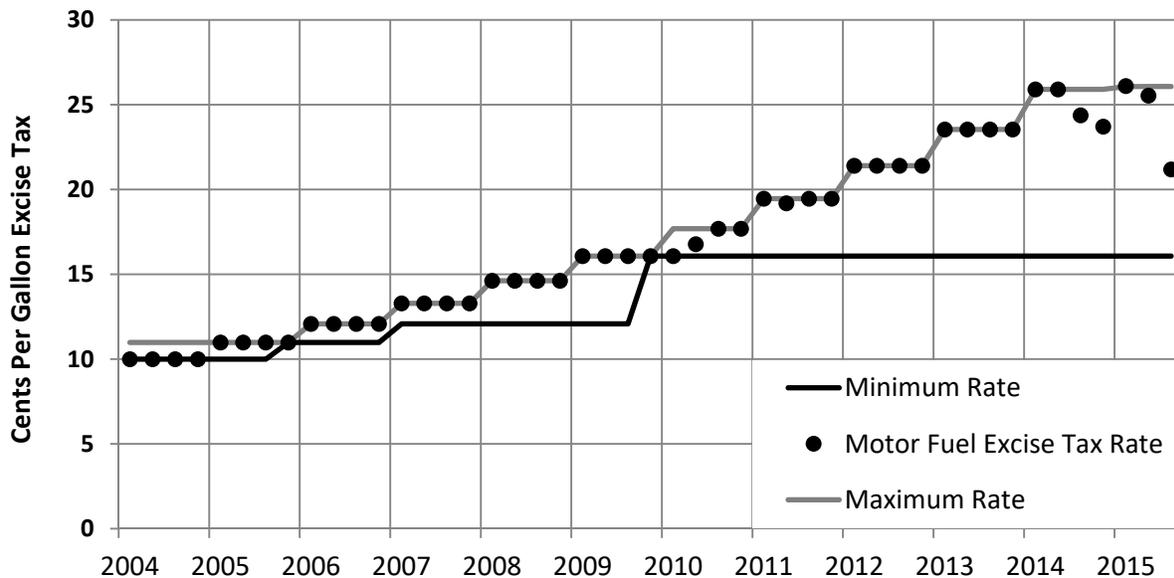
Note: Quarters in which the surveyed AWP was used to set the excise tax rate are represented by larger dots.
Sources: Kentucky. Dept. of Revenue. Division of Miscellaneous Taxes. Gasoline Excise Tax Rate memos, various years; Kentucky. Finance and Administration Cabinet. Handout at Meeting of the Budget Review Subcommittee on Transportation. Frankfort. Nov. 17, 2014.

Figure 2.C shows the minimum and maximum excise tax rates that could be levied and the actual rate levied from FY 2004 through the third quarter of FY 2015. Because the excise tax rate equals 9 percent of AWP, changes in the tax rate correspond to changes in the AWP. In the first half of FY 2014, the excise tax equaled the maximum allowed but then fell by 2.2 cents per gallon in the last half of the fiscal year. The excise tax reached its highest level in the first quarter of FY 2015 but declined the next two quarters. From the first quarter to the third quarter of 2015, the tax declined 4.9 cents from 26.1 cents to 21.2 cents per gallon. These reductions led to lower motor fuels excise tax collections and road fund

^c Changes in the excise tax during a fiscal year occurred in FY 2010, FY 2011, FY 2014, and FY 2015.

receipts. In the third quarter of FY 2015, the 21.2 cents per gallon excise tax was less than the 21.4-cent rate in FY 2012.

Figure 2.C
Minimum, Maximum, And Actual Motor Fuels Excise Tax Rates
FY 2004 To Third Quarter FY 2015



Sources: Kentucky. Dept. of Revenue. Division of Miscellaneous Taxes. Gasoline Excise Tax Rate memos, various years; Kentucky. Finance and Administration Cabinet. Handout at Meeting of the Budget Review Subcommittee on Transportation. Frankfort. Nov. 17, 2014.

In FY 2015, the surveyed AWP fell, causing the excise tax rate to decrease from 26.1 cents per gallon in the first quarter to 21.2 cents in the third quarter.

Setting The Motor Fuels Excise Tax After HB 299. From the beginning of FY 2015 to the third quarter of FY 2015, the AWP from the survey fell from \$3.14 to \$2.354, and the motor fuels excise tax declined from 26.1 cents per gallon to 21.2 cents. If fuel prices had continued to fall, the excise tax rate could have declined an additional 5.1 cents per gallon before reaching its minimum.

The decline in the AWP and the resulting impact on tax revenue occurred when the difference between the minimum and maximum excise tax rates was greatest. By FY 2015, the range of potential excise tax rates was 10 cents per gallon (26.1-cent maximum minus 16.1-cent minimum). The difference in the potential excise tax rates was the largest since the variable rate provisions were adopted in 1980 and represented a potential swing of \$300 million in motor fuels excise tax receipts annually.

The surveyed AWP for the fourth quarter of FY 2015 was below the minimum. This would have resulted in the excise tax rate falling to 16.1 cents.

In early February 2015, the January AWP survey results were released. The January surveyed AWP of \$1.441 per gallon represented a reduction of \$1.70 since the first quarter of FY 2015. The AWP from the January survey was also below the minimum AWP of \$1.786. Therefore, the minimum excise tax rate of 16.1 cents per gallon would have applied for the fourth quarter of 2015. This would have been a reduction in the excise tax rate of 10 cents per gallon. In FY 2016, the maximum excise tax rate would have been limited to 17.7 cents per gallon. This lower maximum would have been below the rates used to develop the state's transportation budget and would have resulted in revenue shortfalls for the road fund.^d

The 2015 General Assembly enacted HB 299, which changed how the excise tax rate was set.

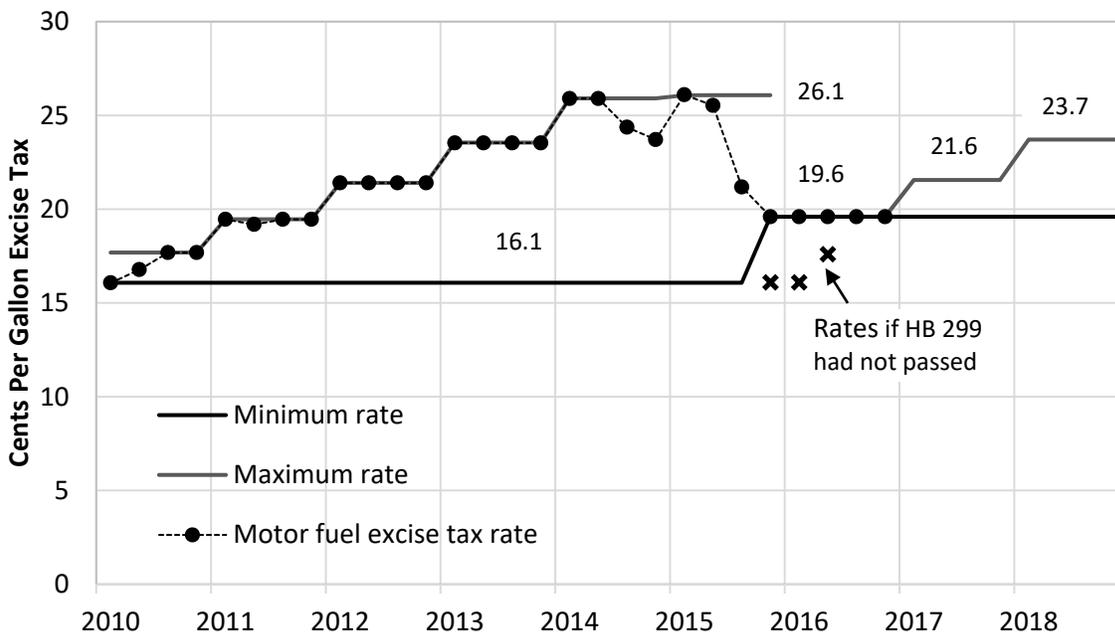
Faced with the prospect of lower motor fuels excise tax revenue, the 2015 General Assembly enacted HB 299, which stipulated that

- the minimum AWP would increase from \$1.786 to \$2.177 per gallon, starting with the fourth quarter of FY 2015;
- in FY 2016, the excise tax rate would be calculated using an AWP of \$2.177 per gallon;
- starting in FY 2017, the AWP used to determine the excise tax rate will be adjusted annually, not by quarter, based on the AWPs from the previous four quarters;
- starting in FY 2017, the AWP used in determining the excise tax cannot exceed 110 percent, or be less than 90 percent, of the AWP in effect at the close of the previous fiscal year.

The effects are shown in Figure 2.D, which displays the excise, minimum rate, and maximum rates under the provisions of HB 299.

^d If the excise tax rate had fallen to the minimum 16.1 cents per gallon, it would have taken 5 years of consecutive 10 percent increases in the average wholesale price for the maximum rate to reach the 26.1 cents per gallon it was at the beginning of FY 2015.

Figure 2.D
Minimum, Maximum, And Actual Motor Fuels Excise Tax Rates
FY 2010 To FY 2018



Note: The maximum excise tax rate for FY 2018 assumes the tax rate for FY 2017 equals the maximum for that fiscal year.

Sources: Kentucky. Dept. of Revenue. Division of Miscellaneous Taxes. Gasoline Excise Tax Rate memos, various years; Kentucky. Finance and Administration Cabinet. Handout at Meeting of the Budget Review Subcommittee on Transportation. Frankfort. Nov. 17, 2014.

HB 299 effectively set the excise tax rate at 19.6 cents for the fourth quarter of FY 2015 and all of FY 2016.

HB 299 effectively set the excise tax rate at 19.6 cents for the fourth quarter of FY 2015 and all of FY 2016. Beginning with FY 2017, the tax rate will be adjusted on July 1 each year. The excise tax rate for each fiscal year will be based on the AWP from the surveys in the previous four quarters. For example, the rate in FY 2017 will be based on the average of the AWP surveys conducted in July 2015, October 2015, January 2016, and March 2016. This change eliminates variation in the tax rate during a fiscal year.

HB 299 raised the minimum AWP to \$2.177 per gallon, resulting in a minimum excise tax rate of 19.6 cents per gallon.

HB 299 places new restrictions on the value of AWP that may be used to set the excise tax rate. HB 299 raised the minimum AWP from \$1.786 per gallon to \$2.177 per gallon beginning with the fourth quarter of 2015. By raising the minimum AWP, HB 299 increased the minimum tax rate from 16.1 cents to 19.6 cents per gallon.

HB 299 limited changes to AWP to 10 percent annually. This also limits changes in the excise tax rate to 10 percent annually.

HB 299 also limits how much the value may change from one year to the next, which also limits changes to the tax rate. Changes in AWP, and therefore the excise tax rate, are limited to 10 percent annually. For example, if the excise tax rate is 22 cents per gallon in a fiscal year, the rate can be no higher than 24.2 cents (22 cents \times 110 percent) and no lower than 19.8 cents (22 cents \times 90 percent) in the next fiscal year. The limits mean that the AWP can never be below \$2.177 per gallon and the excise tax rate can never be below 19.6 cents per gallon.

In FY 2017, the maximum rate will be 21.6 cents per gallon. If the rate is 21.6 cents in FY 2017, the maximum rate will be 23.7 cents in FY 2018. The minimum rate will be 19.6 cents per gallon in FY 2017 and FY 2018. If prices increase sufficiently, the 10 percent limit by which the AWP can fall in a year would affect rates by FY 2019 at the earliest.

Limiting annual increases and decreases each year allows the maximum rate and the minimum rate that may be levied in any fiscal year to change over time. This reduces the difference between the maximum and minimum rate that may be levied in a fiscal year and the potential for large changes in revenue collected.

Figure 2.D shows the excise tax rates that would have been levied if HB 299 had not passed. These rates are denoted by an X. In the fourth quarter of FY 2015, the surveyed AWP was \$1.441 per gallon. Since this price was below the minimum of \$1.786, the excise tax rate would have been 16.1 cents per gallon ($\$1.786 \times 9$ percent). By raising the minimum AWP to \$2.177 per gallon, HB 299 increased the excise tax rate from 16.1 cents per gallon to 19.6 cents per gallon. This is a 3.5-cent increase compared to the rate that would have been levied without HB 299.

HB 299 increased the excise tax rate in three quarters relative to the rate that would have been levied. However, the excise tax rates were lower than the rates levied during the first three quarters of FY 2015.

While HB 299 increased the excise tax rate compared to the rate that would have existed under the previous statutes, the rate for the fourth quarter of FY 2015 under HB 299 was 1.6 cents lower than the rate levied in the third quarter of FY 2015. That is, the rate declined under HB 299 but not as much as it would have if HB 299 had not passed. The rates applied for the first and second quarters of FY 2016 were also lower than in the third quarter of FY 2015 but higher than the rates that would have been applied without HB 299. Overall, HB 299 did not increase tax revenue but reduced the amount that tax revenue would have declined in its absence.

Changes In The Motor Fuels Excise Tax Rate

Table 2.3 displays the AWP used in calculating the motor fuels excise tax, the 9 percent motor fuels excise tax, the change in the excise tax, the total tax for gasoline, and the total tax for special fuels tax. Since the excise tax typically does not change during a fiscal year, the data in Table 2.3 are presented by fiscal year with exceptions made for quarters in which the excise tax changed.

The gasoline tax rate reported in Table 2.3 includes the 5-cent per-gallon supplemental highway user fuel tax and the 9 percent motor fuels excise tax. The special fuel tax rate in Table 2.3 includes the 2-cent-per-gallon supplemental highway user fuel tax and the 9 percent motor fuels excise tax. The 1.4-cent-per-gallon petroleum storage tank environmental assessment fee is not included in the gasoline or the special fuel tax rate in Table 2.3.

In FY 2004, the motor fuels excise tax was 10 cents per gallon. Through the first quarter of 2014, it increased every quarter except one. Beginning with the third quarter of FY 2014, it has declined every quarter except one.

Table 2.3
Average Wholesale Price And Motor Fuel Tax Rates
FY 2004 To Third Quarter FY 2015

Fiscal Year	AWP Used To Set Excise Tax	9% Excise Tax	Change In Excise Tax	Tax Rate	
				Gasoline (Excise Tax + \$0.05)	Special Fuel (Excise Tax + \$0.02)
2004	\$1.110	\$0.100		\$0.150	\$0.120
2005	1.220	0.110	\$0.010	0.160	0.130
2006	1.342	0.121	0.011	0.171	0.141
2007	1.476	0.133	0.012	0.183	0.153
2008	1.624	0.146	0.013	0.196	0.166
2009	1.786	0.161	0.015	0.211	0.181
2010 Q2	1.864	0.168	0.007	0.218	0.188
2010 Q3	1.965	0.177	0.009	0.227	0.197
2011 Q1	2.162	0.195	0.018	0.245	0.215
2011 Q2	2.132	0.192	-0.003	0.242	0.212
2011 Q3	2.162	0.195	0.003	0.245	0.215
2012	2.378	0.214	0.019	0.264	0.234
2013	2.616	0.235	0.021	0.285	0.255
2014 Q1	2.878	0.259	0.024	0.309	0.279
2014 Q3	2.708	0.244	-0.015	0.294	0.264
2014 Q4	2.634	0.237	-0.007	0.287	0.257
2015 Q1	2.897	0.261	0.024	0.311	0.281
2015 Q2	2.837	0.255	-0.006	0.305	0.275
2015 Q3	2.354	0.212	-0.043	0.262	0.232

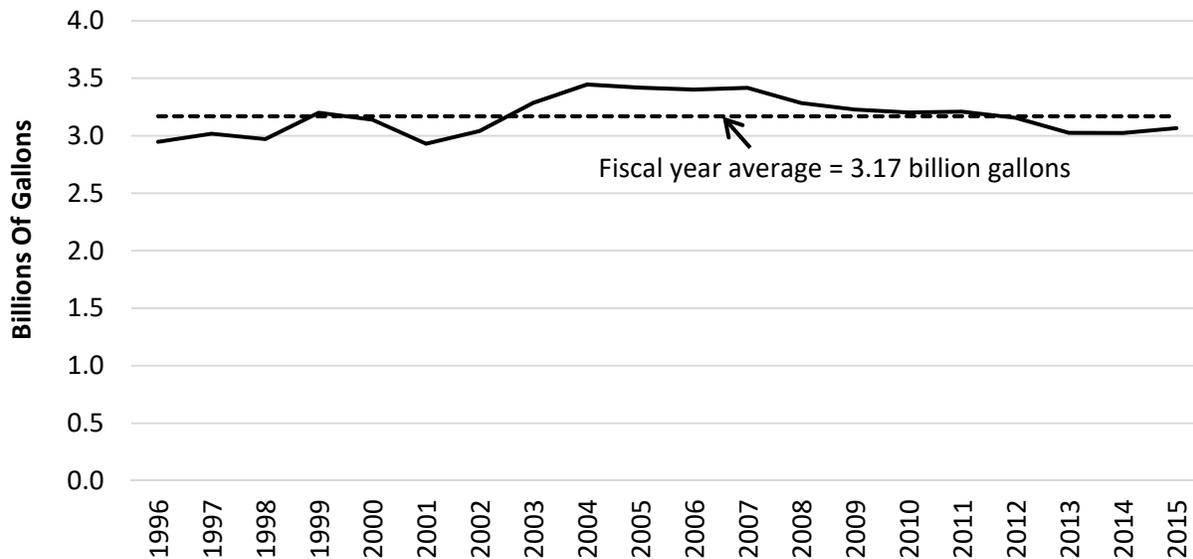
Sources: Kentucky. Dept. of Revenue. Division of Miscellaneous Taxes. Gasoline Excise Tax Rate memos, various years; Kentucky. Finance and Administration Cabinet. Handout at Meeting of the Budget Review Subcommittee on Transportation. Frankfort. Nov. 17, 2014.

Trends In Kentucky's Motor Fuel Taxes And Road Fund

Approximately 3.2 billion taxable gallons of fuel are sold annually in Kentucky.

Taxable Gallons. As shown in Figure 2.E, an average of 3.17 billion taxable gallons per year were sold in Kentucky from FY 1996 to FY 2015. During the 2001 recession, taxable gallons fell to 2.92 billion gallons. Taxable gallons peaked at 3.44 billion in FY 2004. Over the past decade, taxable gallons grew in FY 2007, FY 2011, and FY 2015 but declined during the other 7 years. Taxable gallons for the past 3 fiscal years were below average.

Figure 2.E
Kentucky Gasoline And Special Fuels Taxable Gallons
FY 1996 To FY 2015



Source: Kentucky. Dept. of Revenue. *Monthly Gallonage Report*.

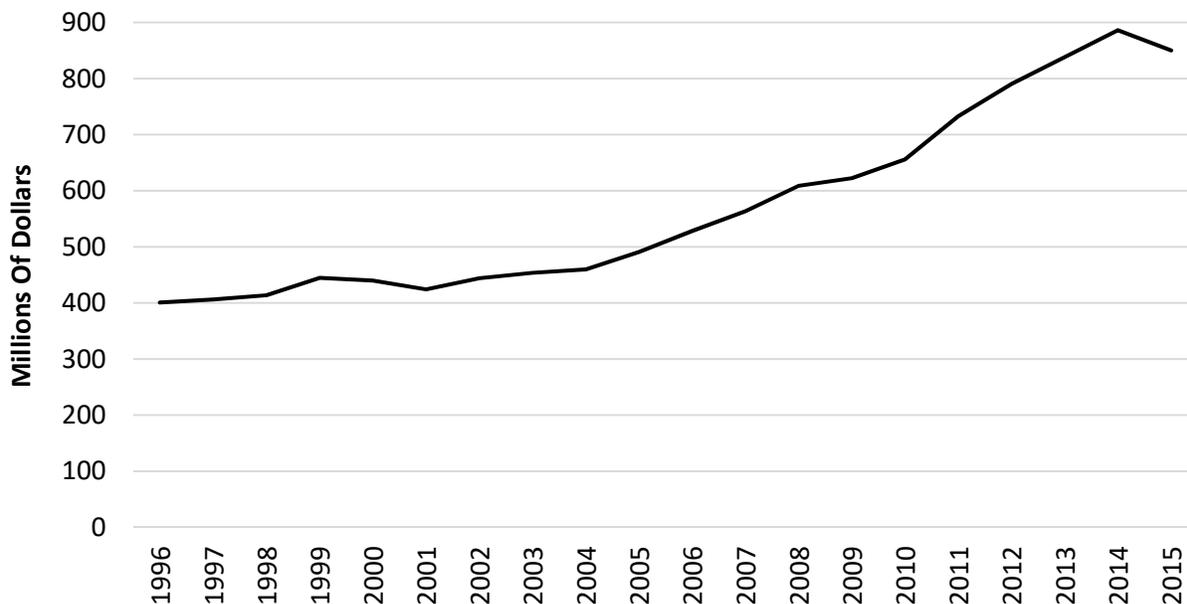
Increases in the motor fuels excise tax rate have contributed to the growth in motor fuel tax receipts. From FY 2004 to FY 2014, motor fuel tax receipts grew by 93 percent.

Motor Fuel Tax Receipts. Figure 2.F displays Kentucky’s motor fuel tax receipts since FY 1996. From FY 1996 to FY 2004, the motor fuel tax rate per gallon did not change; therefore, changes in motor fuel tax receipts were largely tied to changes in taxable gallons during this period.

Since FY 2005, the motor fuels excise tax rate per gallon typically increased by 10 percent each fiscal year. Taxable gallons generally declined once they peaked in FY 2004. As a result, annual changes in motor fuel tax receipts since FY 2004 have been driven largely by changes in the motor fuels excise tax rate.

Cumulative increases in the excise tax rate since FY 2004 had a pronounced effect on motor fuel tax receipts. In FY 2004—just prior to the first excise tax increase—motor fuel tax receipts were \$459.6 million. In FY 2014, motor fuel tax receipts were \$886.2 million—a 93 percent increase relative to 2004. Simply put, motor fuel tax receipts nearly doubled over the past decade. In FY 2015, the motor fuels excise tax rate continued to fall throughout the year, but the tax rate at the beginning of the fiscal year was at a historic high. Motor fuel tax receipts declined from FY 2014 to FY 2015, but total motor fuel tax receipts of \$850.3 million were the second highest on record.

Figure 2.F
Kentucky's Motor Fuel Tax Receipts
FY 1996 To FY 2015



Source: Kentucky. Office of State Budget Director. *Quarterly Economic and Revenue Report, Fourth Quarter Annual Edition*, various years.

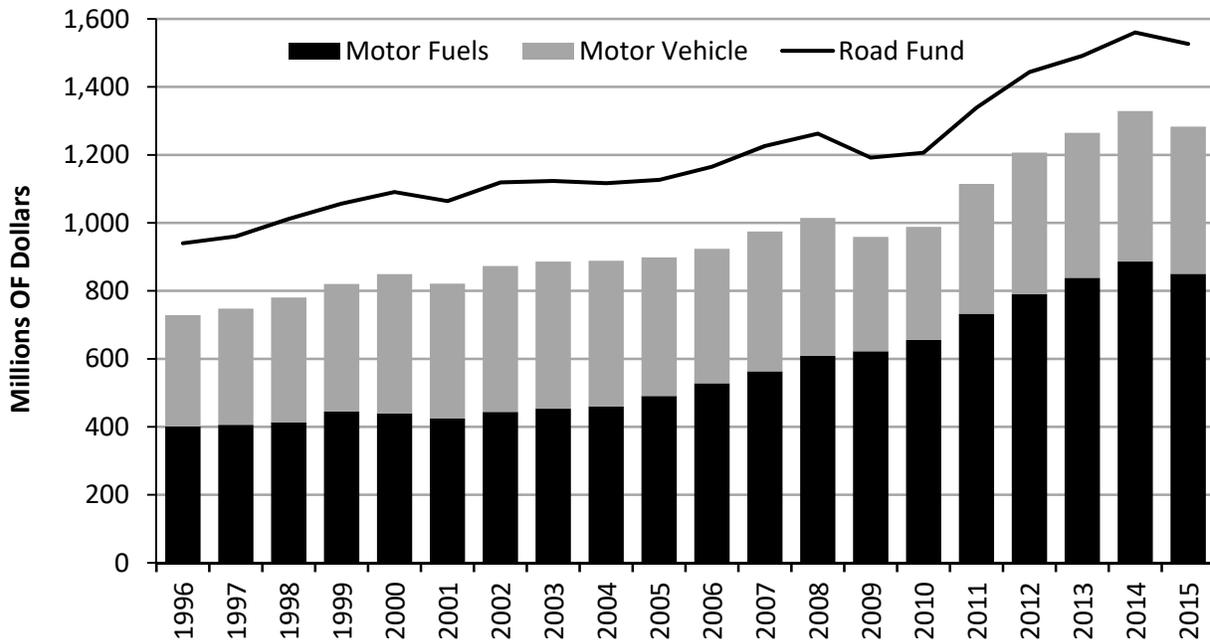
Contribution Of Motor Fuel Taxes To Road Fund. The motor fuel tax and the motor vehicle usage tax constitute approximately 84 percent of the road fund.

Figure 2.G compares motor fuel tax, motor vehicle usage tax, and total road fund receipts. Prior to the 2001 recession, growth in road fund receipts was driven largely by increases in motor vehicle usage tax receipts. Following the recession, road fund growth was due largely to increases in motor fuel tax receipts. In FY 2009 and FY 2010, motor vehicle usage tax receipts declined and growth in motor fuels slowed, resulting in road fund receipts declining to \$1.2 billion.

Since FY 2009, growth in Kentucky's road fund has largely been due to increases in the motor fuel tax.

As growth returned to both motor fuels and motor vehicle usage taxes, road fund receipts rebounded strongly and reached \$1.56 billion in 2014. Motor fuel and motor vehicle usage tax receipts declined in FY 2015, resulting in road fund receipts declining by \$34 million, or 2.2 percent, from FY 2014. Overall, most of the growth in the road fund occurred during the past 5 years and was due primarily to increases in the motor fuels excise tax rate.

Figure 2.G
Kentucky's Road Fund, Motor Fuel, And Motor Vehicle Usage Tax Receipts
FY 1996 To FY 2015



Source: Kentucky. Office of State Budget Director. *Quarterly Economic and Revenue Report, Fourth Quarter Annual Edition*, various years.

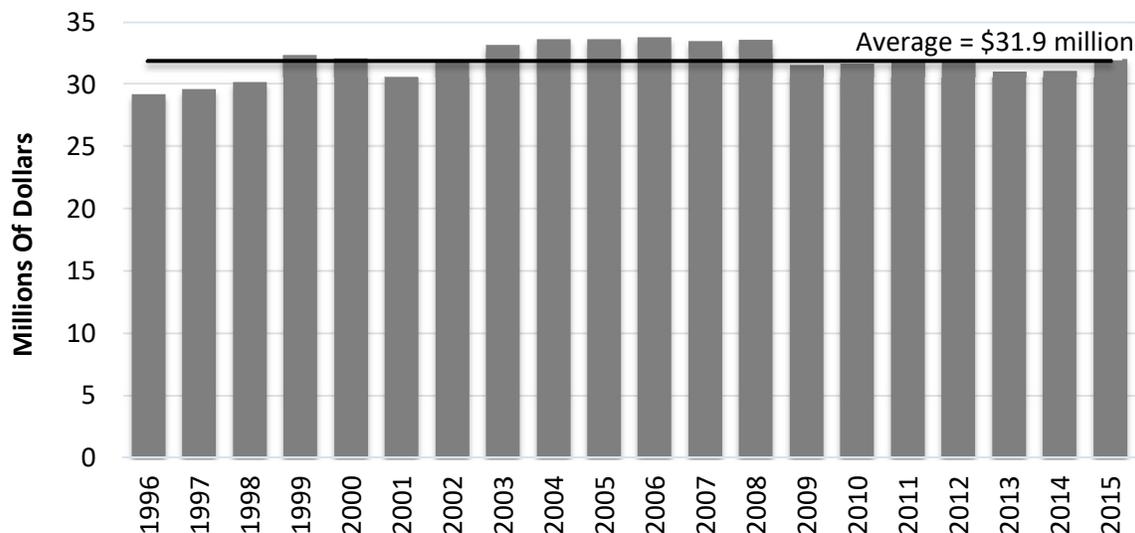
Each penny of the motor fuel tax generates approximately \$32 million in revenue.

Motor Fuel Tax Receipts Per Penny Of Tax Rate. Another way to examine motor fuel tax receipts is to calculate the amount of tax receipts for each penny of the motor fuels excise tax. Figure 2.H displays how motor fuel tax receipts per penny of the tax levied have changed over time. Because there have been no significant changes to the type or amount of fuel taxed, receipts collected per penny are determined primarily by how many gallons of fuel are sold.^e

The motor fuel tax has generated approximately \$31.9 million per penny of the tax. So when the tax rate goes up or down by 1 cent, revenue increases or decreases by roughly \$31.9 million. This amount has varied over the years, and recent declines are related to fuel consumption.

^e Multiplying taxable gallons in a fiscal year by 1 cent will yield nearly an identical per-penny rate as the rates presented in Figure 2.H.

Figure 2.H
Motor Fuel Tax Receipts Per Penny Of Tax Rate
FY 1996 To FY 2015



Source: Kentucky. Office of State Budget Director. *Quarterly Economic and Revenue Report, Fourth Quarter Annual Edition*, various years.

Distribution Of Motor Fuel Tax Revenue

Motor fuel tax revenue is shared by the state, counties, and cities.

Motor fuel tax receipts are shared by the state, counties, and cities to fund the construction and maintenance of roads. Of the total motor fuel tax levied, 2.1 cents per gallon goes to the state's road fund. One-tenth of 1 percent of the revenue, up to \$190,000, goes to the Kentucky Transportation Center at the University of Kentucky (KRS 177.320).^f These are sometimes referred to as "off-the-top" deductions.

Of the remaining revenue, 51.2 percent goes to the state's road fund and 48.2 percent to counties and cities. The counties' and cities' portion is distributed in the following manner as directed by KRS 177.320 and KRS 177.365:

- 22.2 percent for secondary and rural roads
- 18.3 percent for county roads and bridges
- 7.7 percent for urban roads and streets

^f Appropriations during a biennium are governed by provisions contained in each biennial budget. For the current budget period, the Kentucky Transportation Center appropriation is \$290,000 because the statutory allocation has been notwithstanding.

The amounts set aside for secondary and rural roads and county roads and bridges are then allocated by statutory formula based on rural population, rural road mileage, and rural land area:

- One-fifth equally shared among all counties
- One-fifth based on rural population
- One-fifth based on rural road mileage
- Two-fifths based on rural land area (KRS 177.360)

The amount set aside for urban roads and streets is distributed based on population.

Given the revenue-sharing provisions tied to the motor fuel tax, each additional penny of tax provides the resources to support \$15,376,000 in appropriations to city and county governments.^g

^g During the 2015 Regular Session, HB 510 appropriated \$7.8 million from the General Fund to the Revenue Sharing budget unit, as motor fuel tax receipts fell below their budgeted level.

Chapter 3

Comparison Of State Motor Fuel Tax Rates

Thirty-one states have a motor fuel tax with a fixed rate per gallon. Nineteen states have a variable-rate tax.

State motor fuel tax rates per gallon are fixed or vary based on some measure such as gas prices. Currently, 19 states have a variable motor fuel tax rate and 31 have a fixed motor fuel tax rate. In the past 2 years, five states—Maryland, Pennsylvania, Rhode Island, Utah, and Virginia—switched from a fixed to a variable rate.⁶

Motor fuel taxes in the variable-rate states change on a monthly, quarterly, semi-annual, annual, or biennial basis. Motor fuel taxes in variable-rate states often have fixed and variable components similar to Kentucky's motor fuel tax. Motor fuel tax rates in 11 of the 19 variable-rate states are limited by a statutorily imposed minimum or maximum.⁷ On average, variable-rate states have higher tax rates than the US average or the average for fixed-rate states. This difference is due largely to variable-rate states applying a sales tax to motor fuel sales.

Table 3.1 indicates whether states have variable or fixed motor fuel tax rates. Kentucky is listed as a variable-rate state because its motor fuel tax rate is tied to the average wholesale price of fuel. Among surrounding states, Illinois, Indiana, West Virginia, and Virginia have variable rates; Missouri, Ohio, and Tennessee have fixed rates.⁸

Table 3.1
States By Type Of Motor Fuel Tax

Fixed Rate (31)	Variable Rate (19)
Alabama	Rate Varies Solely Because Sales Tax Is Applied To Fuel Sales (5)
Alaska	
Arizona	
Arkansas	
Colorado	
Delaware	California
Idaho	Hawaii
Iowa	Illinois
Kansas	Indiana
Louisiana	Michigan
Maine	Rate Varies With Price Of Fuel (8)
Massachusetts	Connecticut
Minnesota	Kentucky
Mississippi	Nebraska
Missouri	New York
Montana	Pennsylvania
Nevada	Vermont
New Hampshire	Virginia
New Jersey	West Virginia
New Mexico	Rate Varies With Consumer Price Index (6)
North Dakota	Florida
Ohio	Georgia
Oklahoma	Maryland
Oregon	North Carolina
South Carolina	Rhode Island
South Dakota	Utah
Tennessee	
Texas	
Washington	
Wisconsin	
Wyoming	

Sources: Staff analysis of American Petroleum Institute. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015; US. Energy Information Administration. Monthly Gasoline and Diesel Fuel Update. Federal and State Motor Fuel Taxes. July 1, 2015. Web. Nov. 11, 2015.

Motor fuel tax rates in 5 of 19 variable-rate states vary solely because the sales tax is applied to the fuel price.

Variable-rate states in Table 3.1 are divided into three categories based on how their motor fuels tax rates change. Five states have fixed motor fuel excise tax rates and apply their state sales tax to motor fuel sales. As a result, their motor fuels tax changes with fuel prices. In these five states, the motor fuel tax rate varies solely because the sales tax is applied to the fuel price.⁹

The motor fuel tax is based on the AWP of fuel in 8 of the 19 states

Eight variable-rate states adjust their excise tax based on the AWP of fuel. The manner in which this is done varies.^h The motor fuel tax in Kentucky, Nebraska, Virginia, and West Virginia is a percentage of the AWP. Connecticut, New York, Pennsylvania, and Vermont levy either a specific tax on petroleum companies or a special fee or assessment.^{i 10} The motor fuel taxes in these four states are summarized below.

- Connecticut’s petroleum products gross earnings tax is 8.1 percent of the AWP of gas. Statutes limit the AWP that can be used to determine the tax to \$3 per gallon.
- New York’s petroleum business tax varies annually based on the price of petroleum products. The tax is a flat rate per gallon that is adjusted annually based on changes in the producer price index for refined petroleum products, primarily gas and diesel fuel. Annual rate adjustments are limited to plus or minus 5 percent.
- Pennsylvania’s oil company franchise tax is a percentage rate tax that varies for gas and diesel. The percentage rate is multiplied by the AWP to determine the fuel tax rate. The minimum AWP used to determine the rate will be \$2.99 per gallon beginning in 2017.
- Vermont has two special motor fuel levies. The motor fuel transportation infrastructure fee is a 2 percent levy on the retail price of gasoline. The motor fuel tax assessment is a 4 percent levy, not to exceed 18 cents per gallon, on the retail price of gasoline.

Motor fuel tax rates are adjusted by the consumer price index in 6 of the 19 variable-rate states.

The six remaining variable-rate states allow their motor fuel tax rate to change based on changes in inflation as measured by the consumer price index (CPI).^{j 11} The variable component of the motor fuel tax in these six states is summarized below.

- Florida has seven motor fuel tax components, one of which—the sales tax component—is indexed to changes in the CPI.
- Georgia recently restructured its motor fuel tax, and the changes that were adopted are unique among the variable-rate states. In 2015, Georgia’s 4 percent state sales tax was removed from fuel sales and the motor fuels excise tax was increased.

^h In three of these eight states, variability in the motor fuel rate is also tied to the sales tax. New York applies the state sales tax to fuel sales; Nebraska and West Virginia levy a motor fuels wholesale sales tax.

ⁱ Delaware, New Jersey, Ohio, and Washington have a gross receipts tax but are not categorized as variable-rate states. These states are not included because a minimal rate is imposed in each state, leading to minor variability in tax rates.

^j Maine repealed CPI indexing in 2012. Massachusetts voters repealed CPI indexing in 2014.

On January 1, 2016, the excise tax will be adjusted based on changes in the fuel efficiency of cars purchased in Georgia and changes in the CPI. The CPI adjustment applied to the excise tax will end on July 1, 2019.

- Maryland's excise tax is indexed to annual changes in the CPI. The annual change in the excise tax cannot exceed 8 percent. Maryland also levies a sales and use equivalent tax, which is applied to the annual AWP of gasoline.
- North Carolina's rate will be adjusted based on changes in population and changes in the CPI beginning in January 2017. Changes in population will be weighted at 75 percent, and changes in the CPI will be weighted at 25 percent.
- Rhode Island adjusts its excise tax every 2 years based on the CPI.
- Utah will move from a motor fuels excise tax to a motor fuel sales tax on January 1, 2016. The sales tax will be applied to the annual AWP. The minimum AWP used to determine the tax is \$2.45 per gallon, and the maximum AWP is \$3.33 per gallon. The minimum AWP will be adjusted annually based on changes in the CPI.

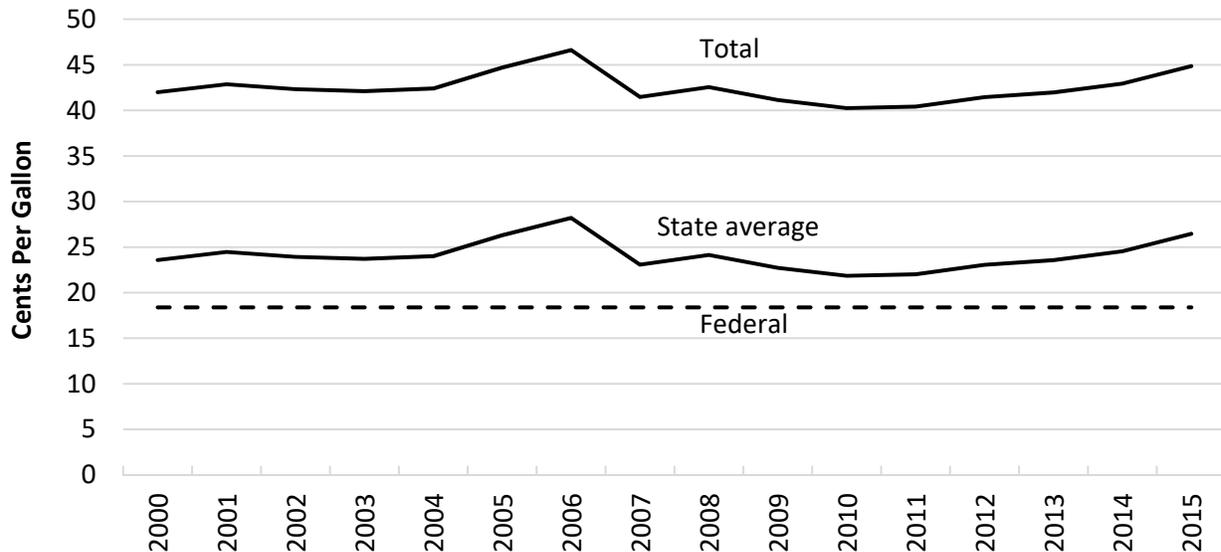
Trends In US And Average State Gasoline Tax Rates

The federal gasoline tax of 18.4 cents per gallon has not changed since 1993.

The federal gasoline tax of 18.4 cents per gallon and diesel tax of 24.4 cents per gallon have not changed since 1993.¹² Figure 3.A displays the federal, state average, and total gasoline tax from 2000 to 2015. The state average tax rate for gasoline is a composite of 50 state motor fuel tax rates, and annual changes are primarily due to changes in fuel prices and legislative changes. Because the federal gasoline tax rate has not changed since 1993, changes in the total tax rate are due to changes in the state average gasoline tax rate.

Since 2000, the state average gasoline tax has varied from 22 to 28 cents per gallon, and total taxes have ranged from 40 to 46 cents per gallon. The average state gasoline tax increased just prior to the 2007-2009 recession, reaching 28.2 cents per gallon in 2006. This increase in the average tax rate was due chiefly to increases in the retail price of gasoline. As retail gasoline prices fell during the recession, and even for a short time thereafter, the average state gasoline tax declined to 21.8 cents per gallon.

**Figure 3.A
 Federal And State Gasoline Tax Rates
 2000 To 2015**



Source: United States. Energy Information Administration. Gasoline and Diesel Fuel Update, Gasoline Pump Components History. Nov. 9, 2015. Web. Nov. 16, 2015.

Since 2000, the percentage change in gasoline prices has been much larger than the percentage change in the state average tax.

One reason is that the 31 states with fixed rates do not change rates very often. In May 2015, the Institute on Taxation and Economic Policy reported that the average interval since the last gasoline tax increase for the 31 fixed-rate states was more than 16 years.¹³

Second, in many variable-rate states, tax changes are tied to changes in fuel prices. However, a number of variable-rate states impose a maximum and/or a minimum value on the price used to set the tax rate. There also may be a time lag between the fuel price change and the tax change. As a result of these two factors, the full impact of fuel price changes may not directly affect state motor fuel taxes or it may do so slowly.

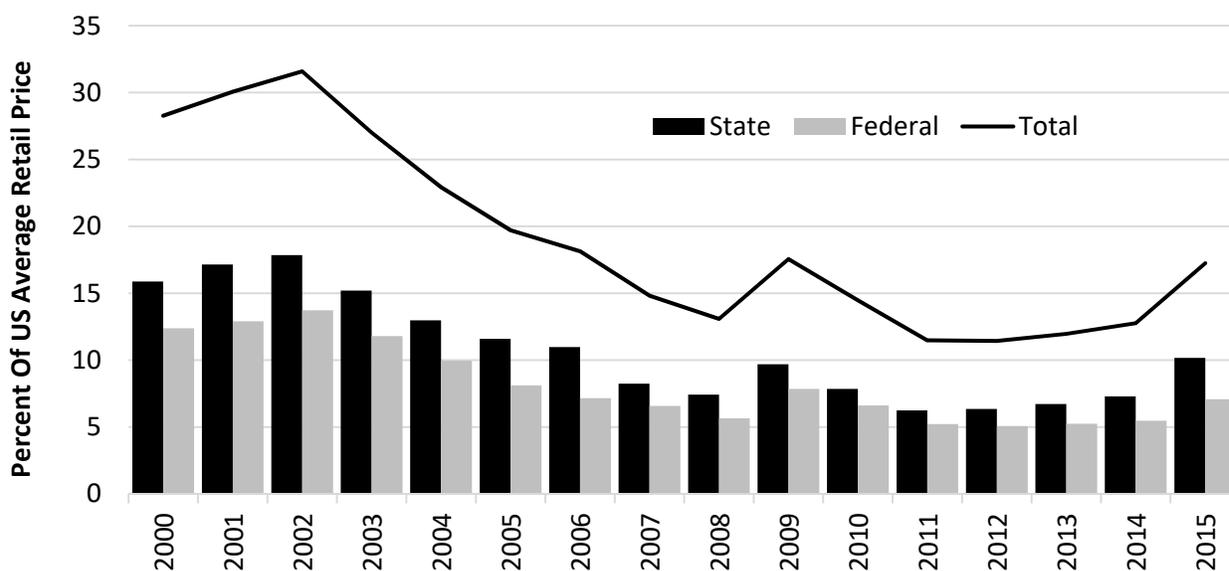
The average state gasoline tax increased from 22 cents per gallon in 2010 to 26.5 cents in 2015.

Since 2010, the average state gasoline tax has grown from just under 22 cents per gallon to 26.5 cents per gallon. The fundamental difference between this recent rise in the state average rate and the increase that occurred from 2000 to 2006 is that the recent tax rate increase occurred as the retail price of gas declined. This recent increase in the state average rate is likely being driven by two factors. First, over the past several years, a number of fixed- rate states have raised their gasoline tax rate. Second,

several of the states that adopted a variable rate implemented a minimum AWP that resulted in tax rates above their previous rates.

As shown in Figure 3.B, the combined federal and average state gasoline tax as a percentage of the average retail gas price has declined since 2000. In 2000, gas taxes were 28.3 percent of the average retail price. In 2015, the percentage was 17.3. Because the federal gasoline tax has not changed, the federal tax as a percentage of the retail price of gas declines as the retail price increases.

Figure 3.B
Federal And State Taxes As A Percentage Of Average Retail Gas Price



Source: United States. Energy Information Administration. Gasoline and Diesel Fuel Update, Gasoline Pump Components History. Nov. 9, 2015. Web. Nov. 16, 2015.

Since 2000, state motor fuel taxes as a percentage of the retail price of gasoline have generally declined.

Since 2000, average state taxes have accounted for a greater percentage of the retail price than federal taxes have. Since 2007, the state gasoline tax has been less than 10 percent of the retail price of gasoline. Since 2005, state and federal gasoline taxes have totaled less than 20 percent of the average retail price of gasoline.

Recent State Motor Fuel Tax Legislation

In the past 2 years, 15 states have enacted legislation changing their motor fuel taxes. Thirteen states increased and two states decreased their tax rates.

During the past 2 years, 15 states passed legislation modifying their motor fuel taxes. The legislative changes resulted in an increase in the motor fuel tax in all but two of these states.

Table 3.2 lists the 15 states that recently adopted motor fuel tax changes, the change in the gasoline and diesel tax rate in each state, and the year the legislation was enacted. New York and North Carolina were the only two states to decrease rates. The decline in New York was small—a one-half-cent reduction for gasoline and diesel. North Carolina’s motor fuel rates declined by 1.5 cents per gallon in 2015 and will decline by an additional 1.5 cents per gallon in 2016. The reduction by 3 cents per gallon in North Carolina was less than the decline that would have happened under the previous law. Also, beginning January 1, 2017, North Carolina will move to a variable rate based on population and CPI.¹⁴ This change will likely result in higher motor fuel tax rates in the future.

For the 13 states with rate increases, the rate changes ranged from approximately 1 cent per gallon in Alaska to 13.4 cents per gallon in Vermont. The average gasoline tax increase in these 13 states was 6.0 cents per gallon, and the average increase in the diesel tax was 5.3 cents per gallon.

Table 3.2
State Motor Fuel Tax Changes
2013 To 2015

State	Change In Rate (Cents Per Gallon)		Year
	Gasoline	Diesel	
Vermont	13.4	3.0	2013
Iowa	10.0	10.0	2015
Wyoming	10.0	10.0	2015
Idaho	7.0	7.0	2015
Washington	7.0	7.0	2015
Georgia*	6.7	7.7	2015
South Dakota	6.0	6.0	2015
Utah*	4.9	4.9	2015
New Hampshire	4.2	4.2	2014
Kentucky*	3.5	3.5	2015
Massachusetts	3.0	3.0	2013
Nebraska*	1.5	1.5	2015
Alaska	0.95	0.95	2015
New York	-0.5	-0.5	2015
North Carolina*	-1.5	-1.5	2015

*Georgia's legislation included a \$5 per night hotel tax—the proceeds will be used to fund transportation projects. Kentucky's rate increased relative to the rate under the previous law but will remain the same in FY 2016. Nebraska and Utah passed legislation in 2015, but the changes will not take effect until January 1, 2016. North Carolina's rate was reduced but will increase on January 1, 2017, due to a change to variable-rate indexing.

Sources: Slone, Sean. Council of State Governments. *State Gas Tax Increases, 2015*. July 2015. Web. Nov 16, 2015; Natl. Conference of State Legislatures, Recent Legislative Actions Likely to Change Gas Taxes, July 21, 2015. Web. Nov. 16, 2015; Amer. Petroleum Inst. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015.

State Gasoline And Diesel Tax Rates

Gasoline

Kentucky's gas tax of 26 cents per gallon is slightly below the 27.17-cent average of all states.

Figure 3.C displays the gasoline motor fuel tax rates by state. The average state gasoline tax is 27.17 cents per gallon.^k State gasoline taxes range from 8.9 cents per gallon in Alaska to 51.6 cents per gallon in Pennsylvania. Kentucky's gasoline tax rate of 26 cents per gallon is slightly more than 1 cent per gallon below the average and is the 28th highest.

^k The average in Figure 3.C and Figure 3.D is calculated based on the data available on November 1, 2015, and excludes local sales and excise taxes applied to motor fuels.

On average, states with variable tax rates for gasoline have higher tax rates than do fixed-rate states.

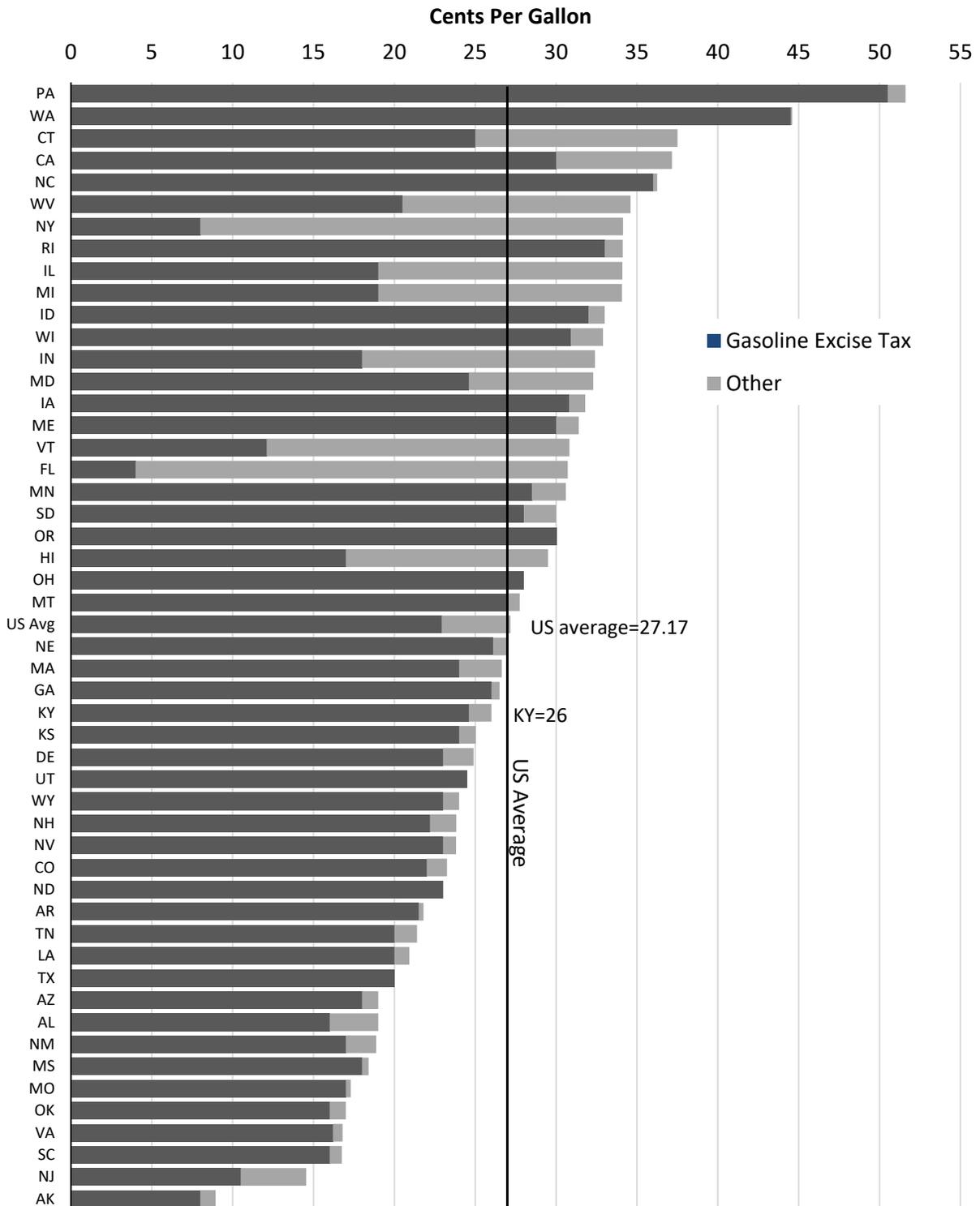
The average gasoline tax rate in the variable-rate states is approximately 8 cents per gallon higher than the average in the fixed-rate states. The average gasoline tax rate among variable-rate states is 32.11 cents per gallon, nearly 5 cents above the average for all states.¹ The average gasoline tax rate among fixed-rate states is 24.14 cents, approximately 3 cents a gallon less than the average for all states.

In Figure 3.C, the total gasoline motor fuel tax rate is divided into excise tax rate and other. The “other” category includes the state sales tax if it applies to motor fuel sales and any assessments or fees that are levied per gallon. Examples of assessments and fees that may be levied are underground and aboveground storage tank fees, environmental assurance fees, inspection fees, license fees, hazardous substance fees, and remediation fees. Most states levy one or two of these fees, and the rate for each fee is typically 1 cent per gallon or less. In those states that apply a sales tax or other type of ad valorem (percentage-based) tax to motor fuels, the “other” category generally comprises a large percentage of the total motor fuel tax rate.

Twelve states—California, Florida, Hawaii, Illinois, Indiana, Maryland, Michigan, Nebraska, New York, Utah, Vermont, and West Virginia—apply a state sales tax to motor fuels.¹⁵ All but Nebraska and Utah have a gasoline motor fuel rate above the average for all states. Nebraska’s rate is just below the US average rate. Utah’s rate will exceed the US average on January 1, 2016.¹⁶

¹ Fourteen of the 19 variable-rate states have a gasoline rate above the average.

Figure 3.C
State Gasoline Motor Fuel Tax Rates



Sources: American Petroleum Institute. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015; US. Energy Information Administration. Monthly Gasoline and Diesel Fuel Update. Federal and State Motor Fuel Taxes. July 1, 2015. Web. Nov. 11, 2015; Federation of Tax Administrators. State Motor Fuel Tax Rates. Jan 1, 2015. Web. Nov. 16, 2015.

Diesel

Figure 3.D displays the diesel motor fuel tax rates by state. In 23 states, the gasoline and diesel fuel tax rates are the same; therefore, a state's rankings will not change much in comparisons of states by fuel type. In 18 states, the diesel fuel tax is higher than the gasoline tax—the average difference is 3.3 cents per gallon. In nine states, the diesel fuel tax is less than the gasoline tax—the average difference is 2.23 cents per gallon.

Average state tax rates on diesel are 27.97 cents per gallon, higher than Kentucky's 23 cents.

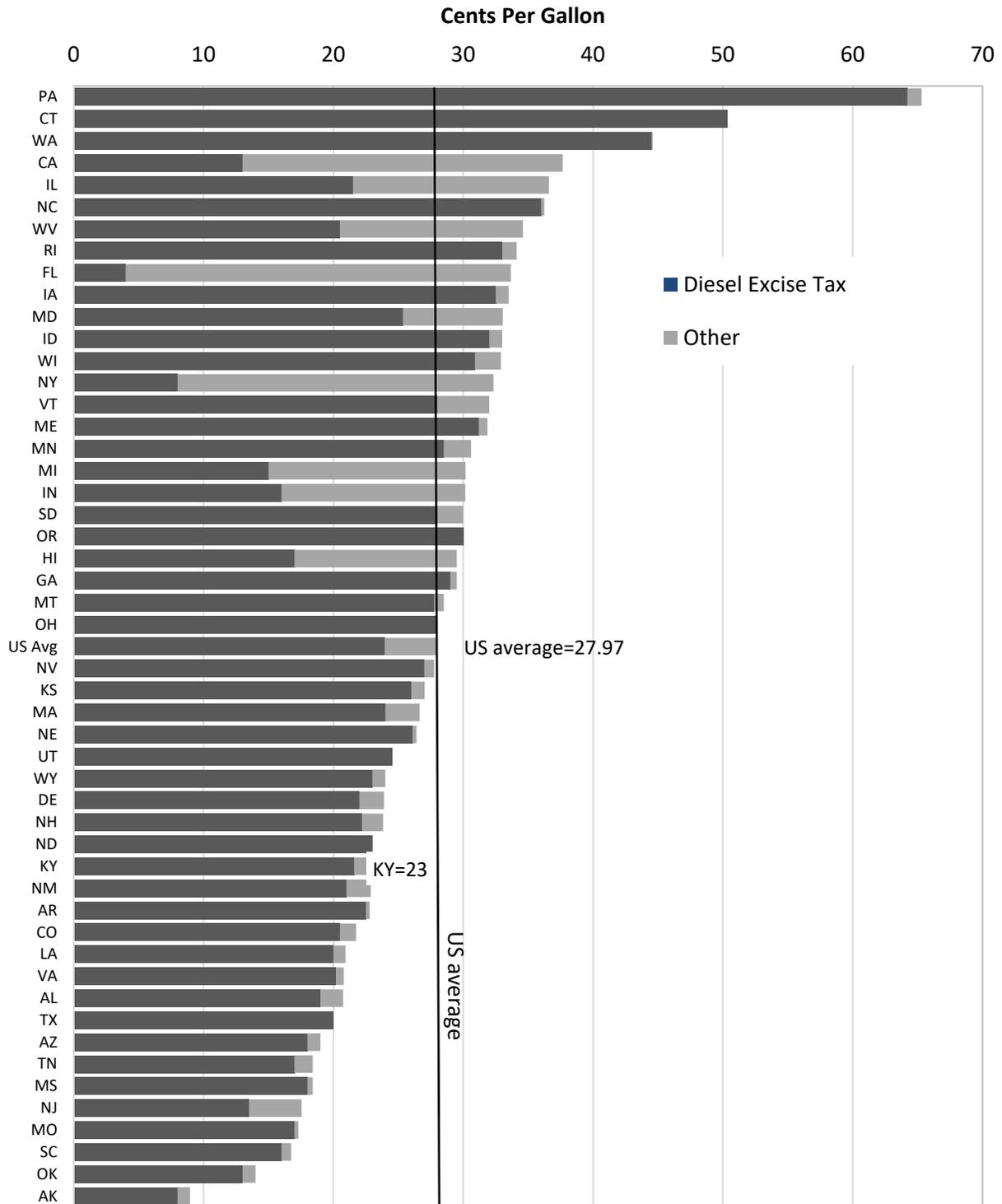
The average state diesel tax rate is 27.97 cents per gallon. Alaska's diesel fuel tax rate is the lowest at 8.95 cents per gallon; Pennsylvania's is the highest at 65.3 cents per gallon. Kentucky's 23 cents per gallon diesel fuel tax rate ranks 35th highest among all states and is almost 5 cents per gallon below the US average. Twenty-three states have a diesel tax rate that is within 5 cents of the average.

On average, states with variable tax rates on diesel have higher tax rates than do fixed-rate states.

The average diesel tax rate in the variable-rate states is almost 9.2 cents per gallon higher than the average diesel tax rate in the fixed-rate states. In comparing the diesel tax rates for the variable-rate and fixed-rate states, the results are similar to those for gasoline. The average diesel tax rate in the variable-rate states is 33.68 cents per gallon, 5.71 cents higher than the average for all states. The average diesel tax rate in the fixed-rate states is 24.47 cents per gallon, 3.5 cents a gallon less than the average for all states.

The diesel motor fuel tax rate for each state in Figure 3.D is divided into excise tax rate and other. The "other" category includes state sales taxes that apply to motor fuel sales in each state and any assessments and fees that are levied per gallon. Of the 12 states that apply a state sales tax to motor fuels—California, Florida, Hawaii, Illinois, Indiana, Maryland, Michigan, Nebraska, New York, Utah, Vermont, and West Virginia—10 have a diesel motor fuel rate that exceeds the average. The two exceptions are Nebraska and Utah. Utah's diesel rate will exceed the average on January 1, 2016.

Figure 3.D
State Diesel Motor Fuel Tax Rates



Sources: American Petroleum Institute. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015; US. Energy Information Administration. Monthly Gasoline and Diesel Fuel Update. Federal and State Motor Fuel Taxes. July 1, 2015. Web. Nov. 11, 2015; Federation of Tax Administrators. State Motor Fuel Tax Rates. Jan 1, 2015. Web. Nov. 16, 2015.

Comparison Of Motor Fuel Tax Rates In Surrounding States

Figure 3.E shows the gasoline motor fuel tax rates for Kentucky and surrounding states. The tax rates represent the amounts paid by drivers of noncommercial vehicles—primarily cars, sport utility vehicles, and light-duty trucks. Figure 3.F shows the diesel motor fuel tax rates for Kentucky and surrounding states. A description of motor fuel taxes in surrounding states appears in Appendix B.

The average gasoline and diesel rate for surrounding states are below the national averages. The average gasoline rate for surrounding states is 0.8 cents per gallon below the average for all states. The average diesel rate in the surrounding states is 1.42 cents below the average for all states.

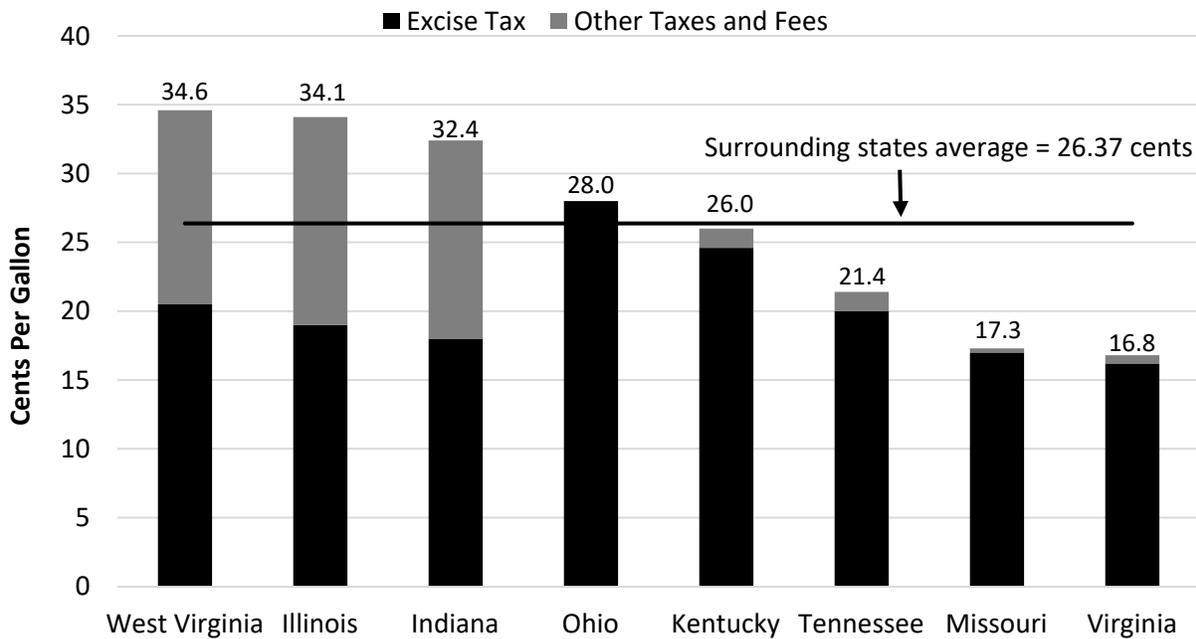
Kentucky's tax rate on gasoline is slightly lower than the average in surrounding states. Kentucky's tax rate on diesel is 3.55 cents lower than the average in surrounding states.

Kentucky's gasoline rate is 0.37 cents below the average in surrounding states. Gasoline tax rates in surrounding states range from 8.6 cents per gallon higher to 9.2 cents per gallon lower than Kentucky's rate. Kentucky's diesel tax rate is 3.55 cents below the surrounding states' average. The diesel tax rates in the surrounding states range from 13.6 cents per gallon higher to 5.7 cents per gallon lower than Kentucky's rate.

Four of the seven states surrounding Kentucky have tax rates on gasoline and diesel that are above the rates in Kentucky.

Of the seven states that surround Kentucky, four have gasoline and diesel motor fuel tax rates above Kentucky's: West Virginia, Illinois, Indiana, and Ohio. Illinois, Indiana, and West Virginia apply a sales tax to motor fuel sales. Three surrounding states—Missouri, Tennessee, and Virginia—have lower gasoline and diesel tax rates than Kentucky. Missouri and Tennessee are fixed-rate states.

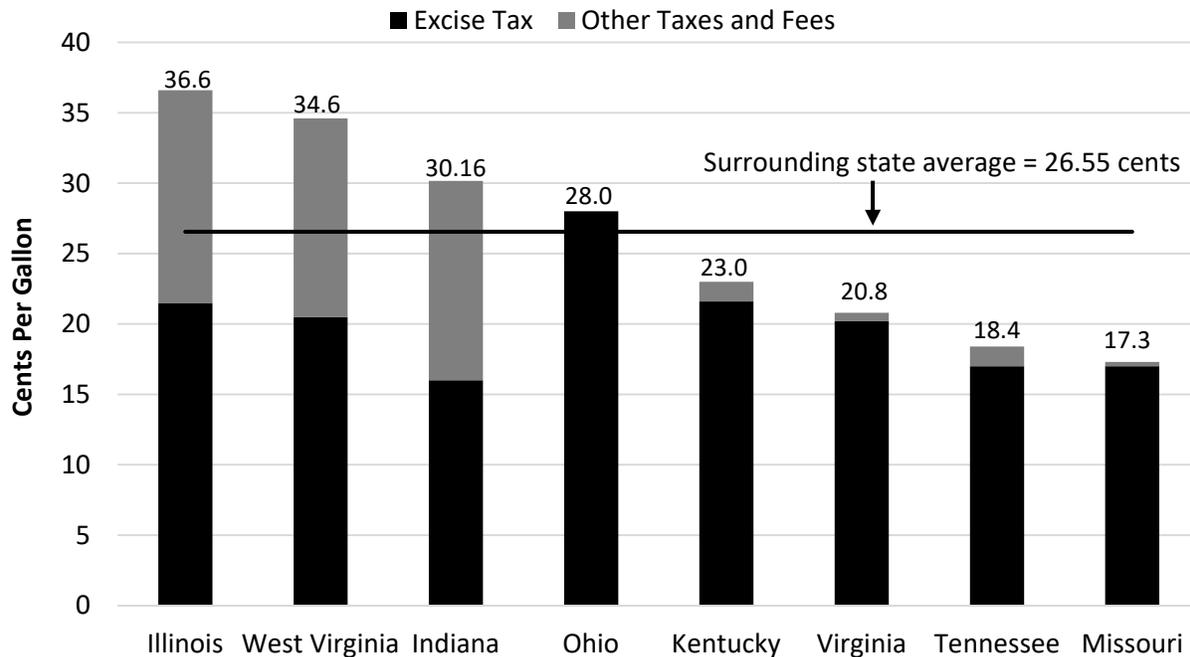
Figure 3.E
Gasoline Motor Fuel Tax Rates In Kentucky And Surrounding States



Note: Other taxes and fees consist of state sales tax (if applied to motor fuels) and assessments and fees levied per gallon. Local sales and excise taxes (levied in Virginia and Illinois), gross receipts taxes on petroleum suppliers (levied in Ohio), and additional taxes that apply only to commercial motor carriers (such as surtaxes, surcharges and weight distance taxes) are not included in this category. Total rates do not include the federal gasoline tax of 18.4 cents or the federal diesel tax of 24.4 cents per gallon.

Sources: Staff analysis of data from American Petroleum Institute. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015; US. Energy Information Administration. Monthly Gasoline and Diesel Fuel Update. Federal and State Motor Fuel Taxes. July 1, 2015. Web. Nov. 11, 2015; Federation of Tax Administrators. State Motor Fuel Tax Rates. Jan 1, 2015. Web. Nov. 16, 2015.

Figure 3.F
Diesel Motor Fuel Tax Rates In Kentucky And Surrounding States



Note: Other taxes and fees consist of state sales tax (if applied to motor fuels) and assessments and fees levied per gallon. Local sales and excise taxes (levied in Virginia and Illinois), gross receipts taxes on petroleum suppliers (levied in Ohio), and additional taxes that apply only to commercial motor carriers (such as surtaxes, surcharges and weight distance taxes) are not included in this category. Total rates do not include the federal gasoline tax of 18.4 cents or the federal diesel tax of 24.4 cents per gallon.

Sources: Staff analysis of data from American Petroleum Institute. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015; US. Energy Information Administration. Monthly Gasoline and Diesel Fuel Update. Federal and State Motor Fuel Taxes. July 1, 2015. Web. Nov. 11, 2015; Federation of Tax Administrators. State Motor Fuel Tax Rates. Jan 1, 2015. Web. Nov. 16, 2015.

Chapter 4

Trends Affecting Motor Fuel Tax Receipts

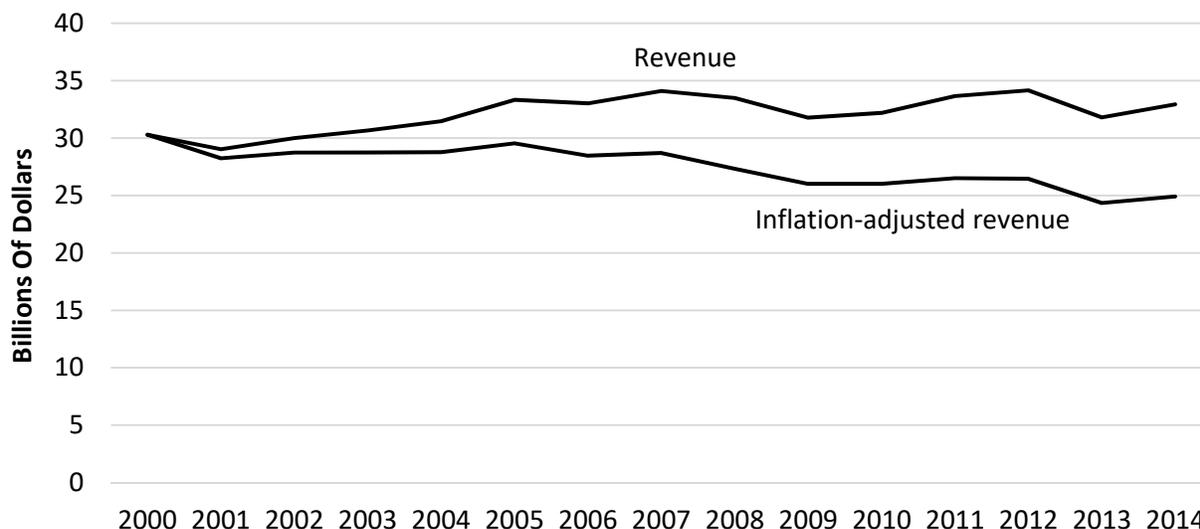
Motor fuel taxes are a primary revenue source that states use to fund transportation infrastructure. In the past decade, many states have faced challenges funding their transportation needs. States have experienced higher inflation and greater demand for transportation projects, but motor fuel tax revenue has been inconsistent, with weak growth.

Within the past 2 years, more than half the states have seen proposed legislation that would enhance or restructure the motor fuels tax. Within the past 3 years, 13 states adopted legislation that increased excise tax rates

Within the past 2 years, more than half the states have seen proposed legislation that would enhance or restructure the motor fuel tax. Within the past 3 years, 13 states adopted legislation that increased the excise tax rates.¹⁷ States have also transferred funds from other sources to support their transportation budgets and generated additional revenues from taxes and fees.

Weak growth in federal and state motor fuel tax receipts has affected states' transportation funding. Figure 4.A shows federal motor fuel tax receipts for federal fiscal years 2000 to 2014. Beginning with federal FY 2000, annual federal motor fuel tax receipts generally exceeded \$30 billion, but annual changes have been inconsistent. Receipts peaked in FY 2007 at \$34.1 billion. Following the recession, receipts recovered, but they have not reached the level attained in FY 2007. In 2014, receipts were \$32.9 billion—9 percent greater than FY 2000 receipts.

Figure 4.A
Federal Motor Fuel Tax Receipts
Federal FY 2000 To Federal FY 2013



Sources: United States. Federal Highway Administration. Highway Statistics 2013. Table FE-210. Sept 25, 2015. Web. Nov 16, 2015; US. Bureau of Labor Statistics. Consumer Price Index. Nov. 16, 2015.

Inflation has eroded the amount that each dollar of road funding can purchase.

Motor fuel tax receipts are used to purchase inputs for road projects such as labor, excavation services, and commodities such as base aggregate (gravel), concrete, asphalt, and steel. Price increases in these inputs erode the amount that each dollar of road funding can purchase. With slow growth in motor fuel revenues and increases in the cost of road project inputs, some states have found it difficult to maintain their level of service in transportation projects.

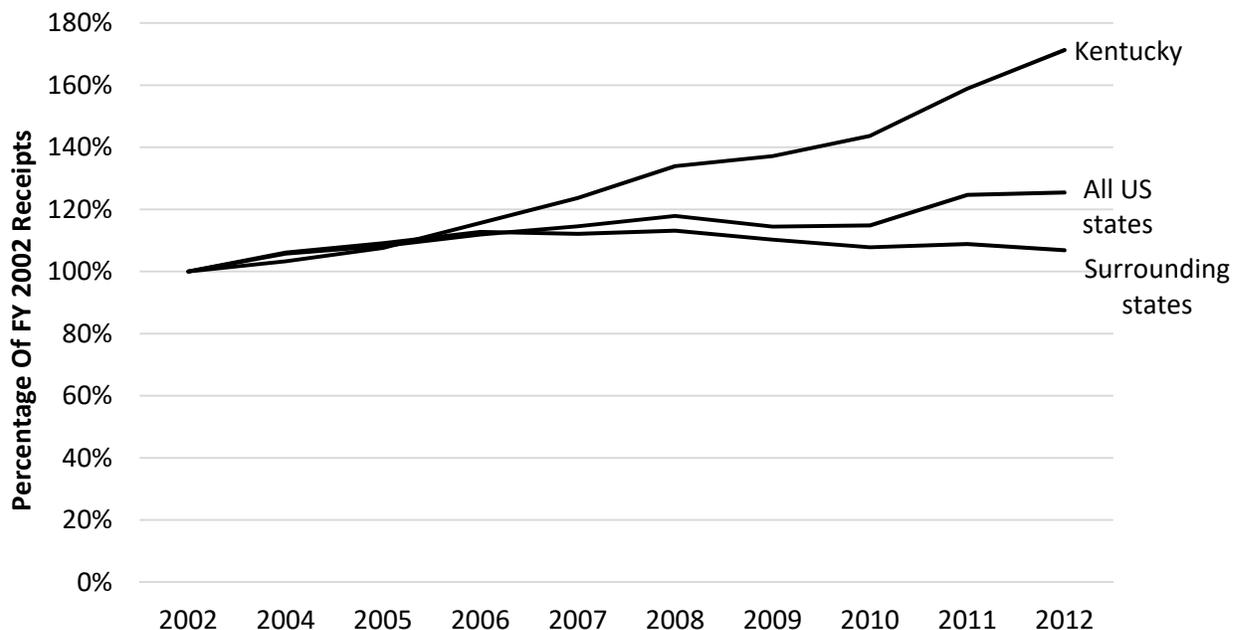
Figure 4.A also shows how inflation affects the purchasing power of federal motor fuel taxes. Staff adjusted the federal motor fuel tax receipts for inflation using the consumer price index. Inflation has outpaced the growth of motor fuel tax revenues. Adjusted for inflation, federal motor fuel tax receipts have fallen from \$30.3 billion in FY 2000 to \$24.9 billion in FY 2014—an 18 percent decline.

Figure 4.B displays the growth in state motor fuel tax revenue from FY 2002 to FY 2012 for Kentucky, surrounding states, and all states. The motor fuel tax revenue for each year is displayed as a percentage of the revenue collected in FY 2002. For example, Kentucky's revenue was \$461.3 million in FY 2002 and \$476.6 million in FY 2004; therefore, FY 2004 is shown as 103.3 percent in Figure 4.B.

Since FY 2002, Kentucky's motor fuel tax revenue has outpaced the surrounding states and all states combined.

Kentucky's growth in motor fuel tax revenue has outpaced growth in the surrounding states and in all states combined. Over this 10-year period, motor fuel tax receipts increased by a little more than 25 percent for all states combined. Motor fuel tax revenues increased by 71 percent in Kentucky and by 7 percent in the surrounding states.

Figure 4.B
State Motor Fuel Tax Receipts As A Percentage Of FY 2002 Receipts
For Kentucky, Surrounding States, And All States
FY 2002 To FY 2012



Source: United States. Census Bureau. 2013 Census of Governments: Finance – Surveys of State and Local Government Finances.

Taxable gallons are determined by vehicle miles traveled and fuel efficiency.

At the federal and state level, growth in motor fuel tax receipts has leveled off over the past 2 decades. Motor fuel tax revenues are determined by the tax rate and the number of taxable gallons. The federal tax rate has remained constant for more than 2 decades; therefore, changes in the level of federal motor fuel revenues are tied to changes in taxable gallons. Taxable gallons are determined primarily by vehicle miles traveled and fuel efficiency.^m

^m Revenues are also affected by exemptions to the fuel tax. Minor changes have been made to the exemptions from the federal motor fuel tax over the past 2 decades.

Figure 4.C displays vehicle miles traveled for Kentucky, its surrounding states, and the US. US vehicle miles traveled are charted on the right-hand scale. Vehicle miles traveled for Kentucky and the states that border Kentucky are charted on the left-hand scale.

The number of vehicle miles traveled in the US has changed little since 2007.

There is a marked difference in the growth in vehicle miles traveled over this time period. Prior to 2001, US vehicle miles traveled consistently increased, but this trend ceased in 2008 with the recession and increases in oil prices. While the number of US vehicle miles traveled is still near the peak of 3 trillion miles per year in 2007, the number of miles traveled has changed little since then.ⁿ

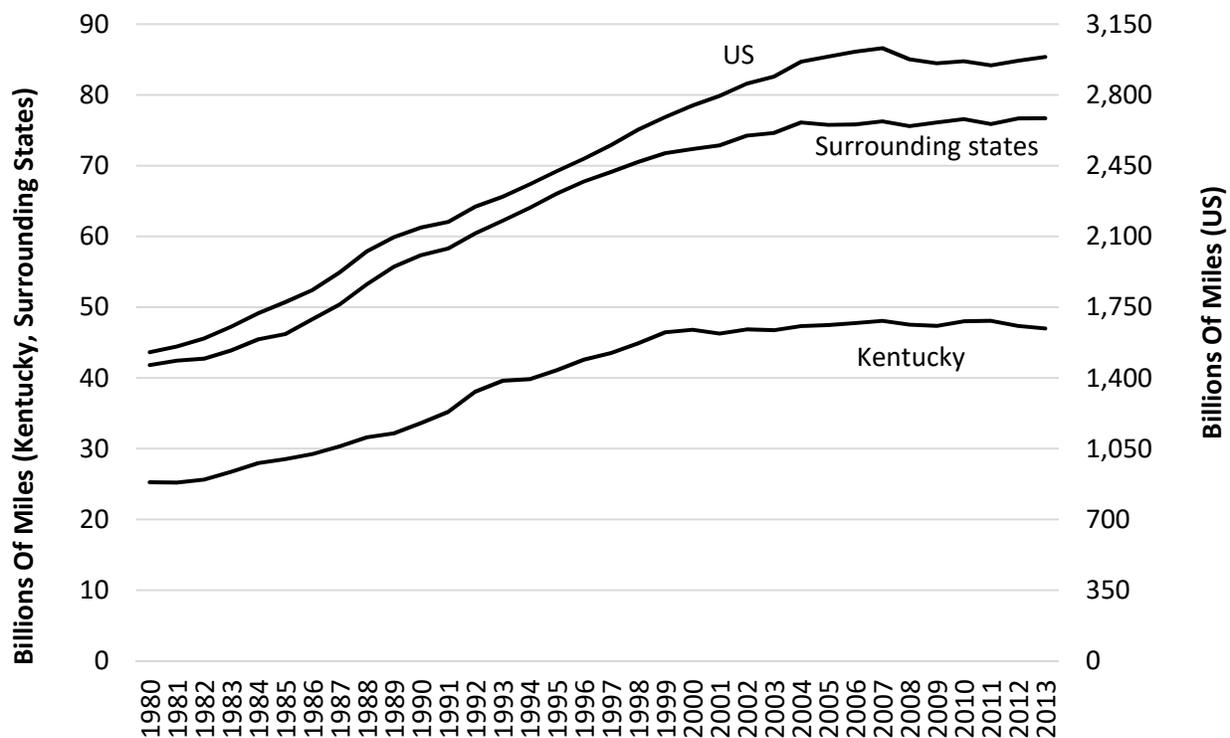
Since the 2007-2009 recession, vehicle miles traveled declined in 28 states and increased in 22 states. Vehicle miles traveled increased by more than 10 percent in Nevada and North Dakota. Growth in the 20 other states that increased was much lower.

On average, Kentucky's vehicle miles traveled increased 0.02 percent per year from 2001 to 2013.

As shown in Figure 4.C, growth in vehicles miles traveled for Kentucky and surrounding states was generally similar to that for the US but slowed earlier. Growth in vehicle miles traveled in Kentucky slowed as the 2001 recession began. While vehicle miles traveled increased from 2001 until the peak of 2007, the rate of growth was slower than from 1980 to 2000. During the 1980s and 1990s, annual vehicle miles traveled in Kentucky grew by 1 billion miles on average—approximately 3.1 percent annual growth. From 2001 to 2013, the average annual increase in vehicle miles traveled in Kentucky was 15 million miles—approximately 0.02 percent annual growth.

ⁿ 2015 preliminary data indicate that the number of US vehicle miles traveled is now above the prerecession level of 3.03 trillion miles.

Figure 4.C
Vehicle Miles Traveled For US, Kentucky, And Surrounding States
1980 To 2013



Sources: United States. Federal Highway Administration. Traffic Volume Trends, various years and Highway Statistics 2013, Functional System Travel – 2013 (1) Annual Vehicle Miles Table VM-2.

Taxable gallons are also influenced by changes in fuel economy. Soon after the 1973 oil embargo, Congress passed legislation to increase the fuel economy of cars and light-duty trucks sold in the US by setting standards for miles per gallon.¹⁸ These standards were known as Corporate Average Fuel Economy (CAFE). CAFE standards are required for new vehicles offered for sale in the US. CAFE standards have increased over time, but their effect on fuel efficiency and the number of taxable gallons sold is gradual.

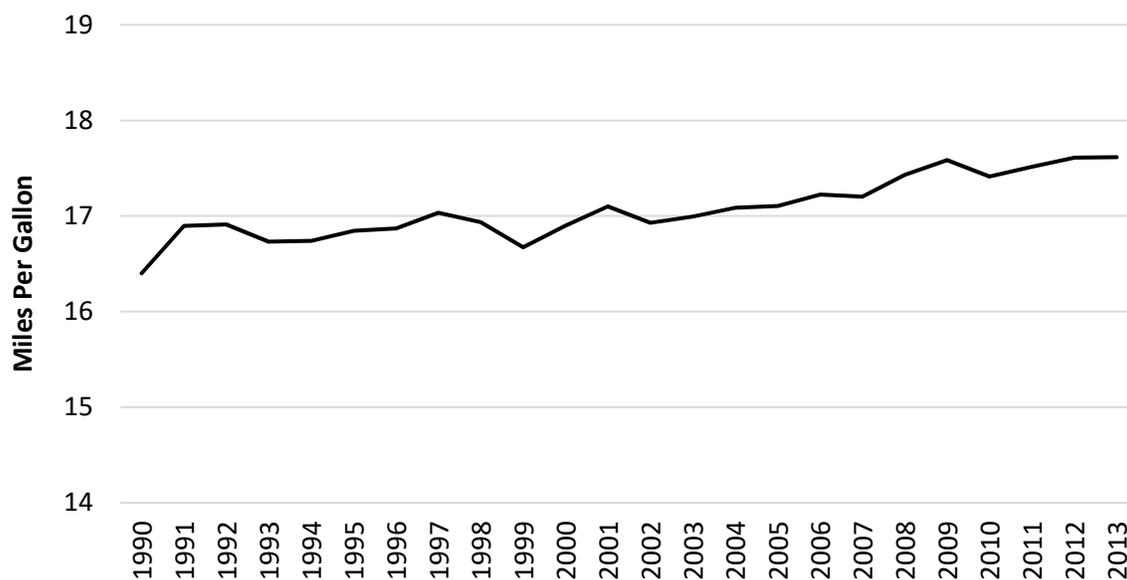
Changes in the fuel efficiency of US light-duty vehicles is driven by fuel efficiency differences between new vehicles purchased and vehicles that are retired. In 2014, new car sales represented approximately 6.6 percent of vehicles.^o According to IHS Automotive, the average age of US cars is at a record high of 11.5 years; thus, US fuel efficiency on average is reflective of the 2004-2005 model year, rather than the 2015 model year.¹⁹

^o Based on new car sales volume of 16.94 million divided by total registered highway vehicles.

In the US, the average number of miles per gallon has grown faster and more consistently since 2001.

Figure 4.D shows the average miles traveled per gallon for the US from 1990 to 2013. The increase in average miles per gallon has been growing faster and on a more consistent basis since 2000. Average miles per gallon was 16.4 in 1990 and increased to 17.6 by 2013. This represents an increase of 0.052 miles per gallon each year. If Kentucky drivers experienced similar fuel efficiency gains as US drivers, then the annual average improvement in fuel efficiency from one year to the next would reduce Kentucky's taxable gallons by approximately 6.2 million gallons. A reduction of this magnitude is equivalent to \$1.5 million in motor fuel tax receipts based on the current motor fuel excise tax rate. As fuel efficiency improves over several years, the total effect on tax revenues grows. For example, if current fuel efficiency were the same as in 1990, motor fuel tax receipts would be 7.3 percent higher using the current tax rate.

Figure 4.D
US Average Miles Per Gallon
1990 To 2013



Source: United States. Energy Information Administration. *Monthly Energy Review*. Oct. 2015. Web. Nov. 16, 2015.

Federal and state motor fuel tax receipts have not grown consistently since 2000 because of improvements in fuel efficiency and the lack of growth in miles traveled. During this period, Kentucky's motor fuel tax revenues have grown. Increases in vehicle miles traveled drove growth in Kentucky's motor fuel taxes revenues until 2004. Growth that occurred after 2004 was due to increases in the average wholesale price of gasoline resulting in higher excise tax rates.

Adoption Of Electric Vehicles In The US

Besides the traditional gas and diesel vehicles, consumers can now choose from numerous types of alternative fuel vehicles, hybrid-electric vehicles, plug-in hybrid electric vehicles, and plug-in electric vehicles.

Plug-in hybrid and plug-in electric vehicles were introduced in the US in December 2010.

Alternative fuel vehicles and hybrid-electric vehicles have been in the marketplace for more than a decade.²⁰ Plug-in hybrid and plug-in electric vehicles were introduced in December 2010.²¹ Hybrid-electric vehicles use two propulsion systems but depend on a traditional or alternative fuel engine to get most of their power. The electric motor in a hybrid is used to provide additional power when needed, and in “full” hybrids electric power can be used as the sole source of power for low-speed driving.²² Given that hybrid-electric vehicles depend on an engine powered by gasoline, diesel, or an alternative fuel, hybrids are not considered in the analysis of electric vehicles that follows.

There are different terms used to describe the various types of technology now being used in automobiles to reduce fuel consumption. Two common terms used to categorize electric vehicles are battery electric vehicles and plug-in hybrid electric vehicles.²³

Battery electric vehicles are all electric and do not have a gasoline, diesel, or alternative fuel engine.^p They are powered by an electric motor linked to rechargeable battery packs. The vehicles generally have a range of 100 miles or less. Once the batteries are depleted, they must be recharged.

In December 2010, the Nissan Leaf was the first battery electric vehicle to be introduced in the United States, and it is the most popular based on total sales. Through October 2015, approximately 87,000 Leafs had been sold in the United States. Tesla Motors introduced the Model S in June 2012 and holds second place in the electric vehicle market. The Tesla Model S has a range of more than 200 miles between charges but is the most expensive electric vehicle in this market segment. In 2015, the Tesla Model S surpassed the Nissan Leaf as the top-selling battery electric vehicle in the country in annual sales.²⁴

Plug-in hybrid electric vehicles have larger batteries than normal hybrid vehicles have. These batteries provide electricity to an

^p Sometimes these vehicles are referred to as plug-in electric vehicles or electric vehicles.

electric motor that powers the vehicle. Once the batteries are depleted to a certain level, the gas or diesel engine begins to produce electricity to power the electric motor and charge the batteries. A plug-in hybrid does not have to be plugged in to be recharged. The batteries may be recharged either by plugging in the car or running the on-board engine. Better performance occurs if the car is recharged by plugging it in.²⁵

The Chevy Volt, introduced in December 2010, is the market leader among plug-in hybrids. Through October 2015, nearly 82,000 Volts have been sold. The Toyota Prius plug-in hybrid holds the second largest market share in the market with approximately 41,000 units sold since it was introduced in February 2012.²⁶

The United States has the most electric vehicles in the world, with 23 models of plug-in hybrid and battery electric vehicles available. Four plug-in hybrid and plug-in electric vehicles—Nissan Leaf, Chevrolet Volt, Tesla Model S, and the Toyota Prius Plug-in—account for more than 70 percent of electric vehicles sold since 2010.²⁷

Approximately 377,000 electric vehicles were sold in the US over the past 4 years. This represents less than 0.2 percent of light-duty vehicles in the US.

Based on sales data from December 2010 to October 2015, 377,000 electric vehicles were sold in the US. There are nearly 260 million light-duty vehicles in the US, so plug-in hybrid and electric vehicles sold in this period represent approximately 0.146 percent of the light-duty vehicles in the US.²⁸

Annual electric vehicle sales as a percentage of new vehicle sales is less than 1.0 percent.

The number of electric vehicles sold has been increasing, and electric vehicle sales as a percentage of total vehicles sold has been rising. Table 4.1 shows the annual sales for plug-in hybrid and plug-in electric vehicles since 2011.

Table 4.1
US Plug-In Hybrid And Electric Vehicle Sales
2011 To 2015

Year	Plug-In And Electric Vehicle Sales	Market Share
2011	17,800	0.14%
2012	53,200	0.37
2013	97,100	0.63
2014	118,682	0.72
2015*	90,247	0.62

*January to October.

Source: Electric Drive Transportation Association. Electric Drive Sales Dashboard. Web. Nov 16, 2015.

Nearly one-half of electric vehicles are located in California.

Sales of electric cars are concentrated in certain states and major metropolitan areas. Nearly one-half of the electric cars in the US are in California, a leader in incentivizing the adoption of electric vehicles. The top five markets for electric vehicle market share of light-duty vehicle sales are California, Georgia, Hawaii, Oregon, and Washington.²⁹

It is likely that there are fewer than 4,000 plug-in hybrid and plug-in electric vehicles in Kentucky.

Adoption of electric vehicles in Kentucky appears to be low. According to the Energy Information Administration, the number of plug-in hybrid and plug-in electric vehicles registered in Kentucky is less than 1 in 1,000.³⁰ Given that the total number of registered motor vehicles in Kentucky is slightly more than 4 million, the data suggest there are fewer than 4,000 plug-in hybrid and plug-in electric vehicles in the state.³¹

Mileage Tax

The effects of increased fuel efficiency and adoption of electric vehicles on state tax revenue have prompted some states to examine taxing drivers based on the number of miles driven. Oregon has conducted the most extensive studies of mileage taxes.

Oregon has conducted the most extensive studies of mileage taxes. Oregon's Senate Bill 810 created a road usage charge based on miles driven.

In 2001, the Oregon state legislature established the Road User Fee Task Force to examine alternative ways to collect revenue for state roads and highways. The state conducted an initial pilot project in 2006 and 2007 and a follow-up pilot project in 2012 and 2013. In 2013, the legislature enacted Senate Bill 810 creating a road usage charge based on miles driven.³²

SB 810 limits participation to 5,000 volunteers and began in July 2015. Participants pay 1.5 cents per mile driven on Oregon roads.

SB 810 limits participation in the road usage charge to 5,000 volunteers. Individuals wishing to participate must apply with the state's Department of Transportation. Participants pay 1.5 cents per mile driven on Oregon roads. Miles driven on private roads are excluded. Participants' mileage is recorded by a device connected to the owner's vehicle. The devices report mileage to vendors who collect the data and prepare invoices for the drivers. Participants still pay the state's fuel tax but receive a credit on their invoice based on an estimate of the amount they paid in fuel taxes.

Although the road usage charge can potentially address reductions in fuel tax revenues caused by improving fuel efficiency, a number of issues remain. Many of these are discussed in reports on Oregon's pilot projects.

Privacy issues may limit the acceptance of a road usage tax.

During Oregon's first pilot project, the task force determined that privacy issues were a serious concern, which may limit the acceptance of a road usage tax. Vehicles must be equipped with devices that record location in order to charge drivers only for miles driven on Oregon's public roads. According to a report by the Oregon Department of Transportation, "Citizens showed grave concerns about the potential for invasion of privacy, particularly about GPS-based mileage reporting devices" and did not believe that protections designed to prevent the government from tracking vehicles "could ever be guaranteed to work."³³

The 2012-2013 pilot project incorporated two provisions that helped address the privacy concerns. First, participants could select a flat fee of \$45 per month rather than the mileage tax. Users selecting the flat fee would not have to provide data on where they were driving. The \$45-per-month flat fee is equivalent to paying the 1.5-cent-per-mile tax based on 3,000 miles during the month or 36,000 miles for a year. This option would likely be attractive only to high-mileage drivers. Participants also had the option of selecting a mileage recording device that did not collect location. The disadvantage of this option is that drivers will be billed for all miles driven including those driven in other states or on private roads.

Under a road usage tax, some drivers may pay more and some less compared to the amount they pay under a gallon tax.

Under SB 810, Oregon will continue to collect its motor fuel tax and participation in the mileage program is voluntary. Owners of fuel-efficient vehicles may pay more under the mileage tax, and therefore, have little incentive to participate. For example, the owner of a car that yields 40 miles per gallon would pay 30 cents for each gallon of gas purchased under the motor fuel tax but 60 cents under the mileage tax. As a result, the owner would be

unlikely to volunteer for the mileage tax. Owners of vehicles with poor fuel efficiency could see their taxes decrease by participating in the mileage program. An owner of a vehicle that yields 15 miles per gallon would pay 30 cents for each gallon used under the motor fuel tax but only 22.5 cents under the mileage tax. This differential creates an incentive for owners of vehicles with poor gas mileage to participate and pay fewer taxes. Given these incentives, voluntary participation could result in the state receiving fewer revenues.

Under a road usage tax, cooperation among states may be needed to address fuel purchased by out-of-state drivers.

If the mileage tax does eventually replace the gas tax, policy makers will have to determine how to address out-of-state drivers. Currently, these drivers pay the state's gas tax when they purchase gas within Oregon. If the mileage tax replaces the gas tax, the state could lose this revenue. SB 810 authorizes the Department of Transportation to develop cooperative agreements with other states to collect the tax, but this will depend on other states adopting the mileage tax.

The Oregon Department of Transportation indicated that mileage recording devices were designed with various methods to prevent tampering. The devices also record when they are installed and removed from the vehicle. The department noted that participants in the pilot project were volunteers and were not expected to attempt to tamper with the devices. Therefore, the pilot project may not provide a complete test of whether the methods to prevent tampering are sufficient.

A fixed-rate mileage tax may address the revenue loss from improved fuel efficiency, but vehicle miles traveled must increase for revenue to increase.

Mileage taxes are often cited in discussions that revenue from fuel taxes is not keeping up with the costs to build and maintain roads. As vehicles become more fuel efficient, drivers pay less in fuel taxes. While adopting a fixed-rate mileage tax could allow states to recoup some of the losses resulting from improved fuel efficiency, it would not necessarily allow revenue to grow. After the initial implementation of a mileage tax, revenue from the mileage tax would increase only if the number of miles driven within the state increases or if the tax rate is changed.

Similar to a gallon tax, a road usage tax will be affected by inflation.

One reason some states' existing fuel tax revenue has not grown as fast as the cost to build and maintain roads is that rates are often fixed to some degree. Revenue collected from fixed-rate fuel taxes grows as more fuel is consumed but does not grow to reflect inflation or the costs of roads. This issue will exist with fixed-rate mileage taxes as well.

Chapter 5

Reformulated Gasoline

The Clean Air Act authorizes the Environmental Protection Agency (EPA) to regulate levels of certain pollutants, one of which is ozone. Gasoline exhaust is a major source of the chemicals that react to form ozone.

The Clean Air Act of 1970 authorizes the Environmental Protection Agency (EPA) to limit concentrations of several pollutants that are known to adversely affect public health. One such pollutant is ground-level ozone, also known as smog. Ozone forms when nitrogen oxide (NO_x) and volatile organic compounds (VOCs) combine. Vehicle exhaust is a major source of NO_x and VOCs.

Reformulated gasoline undergoes additional processing to decrease pollutants emitted when it is burned.

The reformulated gasoline program began in 1995 as part of efforts to help regions meet EPA's limits on ozone. RFG undergoes additional processing to decrease pollutants emitted when it is burned. In 1993, Governor Brereton Jones issued an executive order requiring gas stations in Louisville and Northern Kentucky to sell only RFG starting in 1995 because of high levels of ozone in these areas. This restriction was a component of the state's plan to lower air pollution levels.

This chapter discusses air quality standards required under the Clean Air Act, how RFG contributes to meeting these standards, additional costs associated with RFG, and its potential benefits.

National Ambient Air Quality Standards

The Clean Air Act of 1970 created the National Ambient Air Quality Standards (NAAQS), which are thresholds for the maximum allowable levels of several common air pollutants.

The Clean Air Act of 1970 was enacted to reduce and regulate levels of toxic air pollutants that affect public health, damage ecosystems, and decrease individuals' quality of life. A major component of the Clean Air Act was the creation of the National Ambient Air Quality Standards (NAAQS), which are thresholds for the maximum allowable amounts of several toxic pollutants (42 USC 7409(a)(1)(A)). EPA sets these thresholds at levels that it deems are needed to protect human health and the surrounding environment.

Ozone is the NAAQS-regulated pollutant most affected by the use of RFG. Ozone forms when nitrogen oxide and volatile organic compounds combine in heat and sunlight.

The NAAQS limit concentrations of six common pollutants. The other five pollutants limited by the NAAQS are carbon monoxide, lead, nitrogen dioxide, particulate matter, and sulfur dioxide.³⁴ Ozone is the pollutant most affected by the use of RFG. Ozone forms when NO_x and VOCs combine in heat and sunlight. EPA is responsible for setting and enforcing the standards and monitoring air quality.

Ozone

The main sources of ozone's precursors are vehicle exhaust and industry.

Burning gasoline is one of several major sources of NO_x and VOCs released into the environment. The rate at which pollutants are released from a vehicle's exhaust depends on factors such as the age and size of the vehicle, speed, and the type of gasoline used. In 2008, the average vehicle using conventional gasoline produced more than 50 pounds of VOCs and NO_x annually.³⁵ EPA indicates that "motor vehicles are responsible for nearly one half of smog-forming VOCs, more than half of all NO_x emissions, and about half of the toxic air pollutant emissions in the United States."³⁶ Vehicles are commonly referred to as mobile sources of pollution. Stationary sources such as manufacturers and other industries are another major source of NO_x and VOCs. The natural environment also contributes to ozone as plants emit VOCs during photosynthesis.

Establishment Of The Standards

The standards for the NAAQS may be adjusted by EPA every 5 years upon its review of research assessing the adequacy of current standards to protect public health.

EPA's Clean Air Scientific Advisory Committee reviews the standards every 5 years.³⁷ If the committee determines that existing standards do not adequately protect the health of the public and environment, it recommends more protective standards to EPA (42 USC 7409(d)(1)). EPA has set allowable standards for the six federally regulated pollutants.

Monitoring Compliance

Readings from air monitors throughout the state that measure ozone concentrations from March to October are used to determine whether an area is in attainment with federal standards.

Interspersed air quality monitors measure the volume of pollutants in a given area. The Ambient Air Monitoring Network in Kentucky has 39 stations in 27 counties. Twenty-six stations measure ozone.³⁸ Air monitors measuring ozone are generally placed where ozone concentrations are expected to be elevated, such as in metropolitan areas and near concentrations of industry. Ozone levels are generally higher during the summer because ozone needs heat and sunlight to form. The ozone monitoring season in Kentucky runs from March 1 to October 31.³⁹

EPA uses the pollution measures from these monitors to assign a designation to a geographic area. An area's designation for one pollutant is independent of the designation of another. EPA designates an area as in attainment for a pollutant if the area's measurements are equal to or below the federal standard. An area that does not meet a pollution standard is designated as in marginal to extreme nonattainment for that pollution depending on the level of the pollutant. If EPA has insufficient information, the area is categorized as unclassifiable.

History Of Ozone Standards

Ozone standards have tightened as research continues to find adverse health effects at lower levels of exposure. The first ozone standard was 120 parts per billion (ppb) in 1979; the current standard is 70.

NAAQS were initially promulgated in 1970, but ozone was not regulated until 1979. As shown in Table 5.1, the standard was set at 120 parts per billion (ppb).⁹ In 1997, EPA changed the standard to 80 ppb. In 2008, the standard was changed to 75 ppb. Each time, the new standards were challenged in court, which delayed enforcement of the 1997 standard until 2004 and the 2008 standard until 2012.^{r 40}

Table 5.1
National Ambient Air Quality
Standards For Ozone

Standard (Parts Per Billion)	Established	Implemented
120	1979	1979
80	1997	2004
75	2008	2012
70	2015	2017

Source: United States. Environmental Protection Agency. "Table of Historical Ozone National Ambient Air Quality Standards (NAAQS)." Web. Sept. 15, 2015.

In October 2015, EPA changed the standard to 70 ppb. The new standard could also be challenged. Environmental and public health proponents argue that research has failed to substantiate that ozone levels of 70 ppb protect the public health and ecosystems and that a standard of 60 or 65 ppb would be more appropriate.⁴²

State Implementation Plans And Local Controls

The Kentucky Division for Air Quality is responsible for creating and implementing Kentucky's policies to attain and maintain compliance with federal air quality standards. These policies are outlined in a State Implementation Plan and must be submitted to EPA.

Under the Clean Air Act, state officials may select among policy options to meet the air quality standards. Each state must submit a State Implementation Plan (SIP) to inform EPA of the policies selected. The Kentucky Division for Air Quality is responsible for developing and implementing Kentucky's plan. SIPs generally contain policies regarding the distribution and allocation of

⁹ The standards are referred to in terms of parts per million or parts per billion. The standard 0.075 parts per million equals 75 parts per billion. Parts per billion will be used in this report.

^r EPA also changed how the air quality measures were calculated. Prior to 1997, EPA compared the average of the fourth highest 1-hour ozone values over 3 years to the standards. After 1997, EPA compared the average of the fourth highest 8-hour measures to the standards. The change to the 8-hour-standard took into account that many people spend prolonged periods of time outdoors.⁴¹

stationary emission allowances, emission thresholds, pollution control mechanisms, and strategies for data collection and analysis.⁴³

When federal standards change, states have 3 years to modify their SIPs to demonstrate how they will meet the new standards. If a state's environmental regulators deem that a new federal standard is insufficient, they may implement stricter state-level standards.

Counties may create an air pollution control district to manage local policy. The only active district is in Louisville. The rest of the state is under the authority of the Division for Air Quality.

KRS Chapter 77 allows counties to create air pollution control districts. The district's governing board has authority to regulate and promulgate local policy within the district. Louisville has the only active district in the state. The rest of the state is under the jurisdiction of the Division for Air Quality.

Designation As Being In Nonattainment. States are given 3 years to create a new SIP that contains measures to achieve significant pollutant abatement if a region is designated as being in nonattainment of any of the NAAQS. It is possible for only a portion of a county to be designated as being in nonattainment. New control measures within the revised SIP must include additional emission controls on stationary sources of pollutants.

Failure of an area to come into compliance may result in costly sanctions and a loss of regional authority to EPA.

The time frame a state has to come into compliance before penalties are issued depends on the classification of noncompliance. For example, areas designated as marginally out of compliance generally have 3 years to attain the federal standard. Areas designated as extremely out of compliance—the most severe designation—generally have 20 years to attain the standard. If the standard is not met within the time frame, an area is changed to the next level of noncompliance, and EPA has authority to impose sanctions such as “overriding states on permitting decisions,” requiring “new facilities” to “install the most effective emission reduction technologies without consideration of cost,” and suspending “federally supported highway and transportation projects.”⁴⁴

As of August 2015, Boone, Campbell, and Kenton Counties were designated as marginal nonattainment of the 2008 standards. All other counties were in compliance.

Ozone Standards And Kentucky's Compliance Status. At the time of implementation of the RFG program in 1995, Louisville and Northern Kentucky were designated as being in nonattainment for ozone. Although both regions of the state have exhibited downward trends in ozone concentrations, each has shifted between designations of attainment and nonattainment because of tightening NAAQS standards. Louisville was designated as being in attainment with the 2008 standard upon its official enforcement in May 2012. The three Northern Kentucky counties of Boone,

Campbell, and Kenton were designated as being in the lowest level of nonattainment (marginal nonattainment) with the 2008 standard during the most recent assessment, in October 2015.⁴⁵

Currently, seven counties do not meet the new ozone standard of 70 ppb, although official designations will not occur until 2017.

Based on air quality data collected from 2012 to 2014, Campbell, Daviess, Henderson, Jefferson, Livingston, McCracken, and Oldham Counties do not meet the new ozone standard adopted on October 1, 2015. EPA will not formally designate areas as being in nonattainment with the 70 ppb standard until it has collected sufficient data, likely in 2017.⁴⁶ EPA projects that all but Jefferson County would meet the standard by 2025.⁴⁷

Reformulated Gasoline Program

The Reformulated Gasoline Program was federally mandated in areas with severe ozone levels in 1995.

Although states have some flexibility on how they meet air quality standards, any region in severe violation of the ozone standards in 1990 was required to include a cleaner-burning gasoline program in its SIP. These programs require gas retailers in areas with very high volumes of ozone to sell a cleaner-burning blend of gasoline often referred to as reformulated gasoline. RFG is designed to emit less air pollution than regular gasoline and specifically reduces concentrations of the two pollutants that contribute to ozone.

Although it was not required in Kentucky, Governor Brereton Jones included Louisville and Northern Kentucky in the RFG program in 1993 as one component of the State Implementation Plan.

Governors were given the authority to require RFG in any areas of their states that were in moderate violation. In 1993, Governor Jones issued an executive order requiring RFG in the Louisville and Northern Kentucky areas, which were in moderate violation of the standards.⁴⁸ The program became operational in 1995 and included Boone, Campbell, Jefferson, and Kenton Counties and parts of Bullitt and Oldham Counties.⁴⁹ Currently, cities in 18 states and the District of Columbia use RFG, and it accounts for approximately 30 percent of gasoline sold in the United States.⁵⁰

Effect Of Reformulated Gasoline On Emissions

Under Phase I of the RFG program, which began in 1995, RFG was required to emit 15 percent less NO_x and VOCs and fewer other pollutants than conventional gasoline. EPA reported that areas enrolled in the program experienced a reduction in “pollutants that cause smog by 17 percent,” a reduction in the “emission of toxic pollutants by 17 percent,” and a decrease in benzene concentrations by 43 percent. This translated into 64,000 tons of pollution being kept out of the air each year nationally. These reductions were equivalent to 10 million cars

using conventional gasoline being eliminated from the nation's roads each year.⁵¹

Phase II, in force since 2000, tightened the requirements and requires RFG to emit 22 percent less toxic pollutants, 27 percent less VOCs, and 7 percent less NO_x than conventional gasoline. Phase II RFG reduces pollution an additional 41,000 tons each year compared to Phase I. This is equivalent to another 6 million cars being eliminated from the nation's roads annually.¹⁷

RFG is responsible for a significant reduction in pollution in Kentucky. In Louisville, the use of RFG keeps 7,000 pounds of volatile organic compounds out of the air each summer day. Provisions of the Clean Air Act require that an elimination of the program would need to be accompanied by an equal offset in pollutants by other policies.

The state's voluntary use of RFG in Louisville and Northern Kentucky contributed to the cities' reductions in ozone. The Clean Air Act includes anti-backsliding provisions, which require that states maintain these reductions. If the requirement for RFG is ended, the state would have to adopt other policies that would yield similar emissions reductions as with RFG.⁵² In a 2008 memo, the executive director of the Louisville Air Pollution Control Board explained that RFG reduced VOC emissions in Louisville by 7,000 pounds each summer day. Obtaining similar reductions would require implementing a vehicle emissions testing program or reductions from industries in the area.⁵³

Other Gasoline Regulations

Since ozone formation is amplified in warm conditions, all conventional gasoline must be further processed during the summer to decrease its propensity to evaporate. RFG already meets this requirement, so areas that sell RFG do not need to take additional steps during the summer.

RFG requirements are enforced year round in areas enrolled in the program. Because warm conditions can increase the evaporation of pollutants, the Clean Air Act also limits pollutants during the summer across the 48 contiguous states. Reid vapor pressure (RVP) measures "the intensity with which Volatile Organic Compounds are emitted from gasoline."⁵⁴ Gases refined to lower RVP values require a higher temperature to evaporate and produce less pollution.

RVP standards vary depending on a region's existing pollutant levels and the propensity for ozone to form. The standards are measured as pounds per square inch (psi). The nationwide standard for the RVP of conventional gasoline during the summer is 9.0 psi. However, regions in the south and heavily polluted areas require gasoline with lower summer RVP values.

Gas sold in Floyd and Clark Counties, Indiana, and Cincinnati, Ohio, must have RVP blends of 7.8 psi from June 1 to September 15 each year.⁵⁵ Gasoline sold in non-RFG areas of Kentucky must have an RVP of 9.0 psi from May 1 to September 15.⁵⁶ RFG meets the lowest existing RVP standard of 6.9 psi.⁵⁷ As a result, areas that are required to sell RFP are not required to take additional steps to meet RVP requirements during the summer.

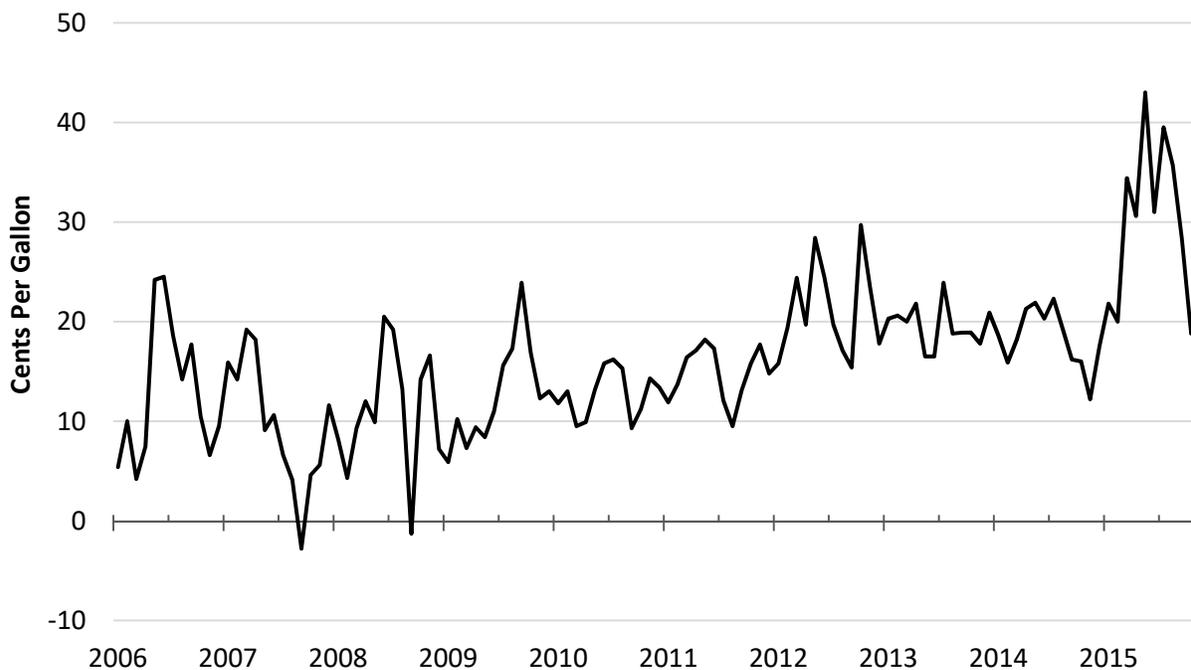
Cost To Consumers

Nationally, reformulated gasoline costs approximately 18 cents more per gallon than conventional gasoline. There is great variation in this difference by season and region.

RFG costs more than conventional gas because of its additional processing. According to the US Energy Information Administration, the retail price for all grades of conventional gas averaged \$3.376 per gallon in 2014. The retail price for all grades of reformulated gas averaged \$3.559 per gallon.⁵⁸ So, reformulated gas cost approximately \$0.18 per gallon more on average than conventional gas in 2014.

The price difference has varied over time. Figure 5.A shows the monthly difference between US prices for reformulated and conventional gasoline from 2006 to October 2015. The additional cost associated with RFG was higher during the first 9 months of 2015, but the price difference declined in September and October.

Figure 5.A
Monthly Differences In Prices For Reformulated And Conventional Gasoline In The US
January 2006 To October 2015



Source: United States. Energy Information Administration.

Although additional refining contributes to a higher cost at the pump, the price is ultimately determined by many other factors. RFG gasoline is sold in Covington and Louisville, but prices in Louisville are generally higher. Prices in Covington were approximately 10.8 cents more expensive than in Cincinnati, which does not use RFG. Prices in Louisville were 10.6 cents higher than in Lexington, which does not use RFG.

The additional cost of RFG can vary by region. Based on data from AAA, Table 5.2 shows average gas prices for Louisville, Lexington, Covington, and Cincinnati from November 2014 to October 2015. RFG is sold in Covington and Louisville. RFG is not required in Cincinnati and Lexington. However, from June to September, gas sold in Cincinnati must have a RVP below 7.8 psi and gas sold in Lexington must have an RVP below 9.0 psi. Prices were approximately 10.8 cents higher in Covington than in Cincinnati. Prices were 10.6 cents higher in Louisville than in Lexington.^s

These differences should not necessarily be interpreted as the additional cost of RFG. Gas prices in an area are affected by factors such as transportation costs, competition, and location. The available data on gas prices by region are generally not sufficient to isolate the effect of RFG from other factors affecting prices. For example, gasoline sold in Louisville and Covington is identical, but the prices differ.

Table 5.2
Average Gasoline Prices In Select Cities
November 2014 To October 2015

City	Average Price Per Gallon
Covington (RFG)	\$2.604
Cincinnati	2.496
Louisville (RFG)	2.539
Lexington	2.433

Source: AAA. Daily Fuel Gauge Report.

RFG could cost Kentucky's residents and businesses \$40 million to \$72 million per year, but these estimates may reflect other factors that affect prices.

According to the US Energy Information Administration, approximately 1.1 million gallons of RFG were sold per day in Kentucky in 2014.⁵⁹ The total was nearly 399.7 million gallons for the year. To provide an idea of the additional amount spent on RFG in Kentucky, staff applied the price differences of 10 and 18 cents to the volume of RFG sold in Kentucky. If these differences represent the additional cost of RFG, this suggests RFG could cost Kentucky residents and businesses approximately \$40 million to \$72 million per year.^t As noted, these differences could represent other factors as well as RFG.

^s There are additional costs to refine gasoline that meets the RVP requirements during the summer months. As a result, the prices differences between cities may be smaller during the summer months and larger during other months.

^t The price difference between RFG and conventional gasoline nationally has been higher in 2015 than in 2014, which could cause estimates of the additional cost of RFG to be higher for 2015.

Research suggests that regulated fuel markets may reduce competition in an area, which could increase prices.

Beyond the higher cost of production, RFG requirements may affect prices by reducing competition in an area. There are many RFG blends, so if a particular blend can be sold only in a small geographic area, companies might find that producing the blend does not justify its additional cost. Remaining companies might have less pressure to keep prices competitive. There is evidence that requiring specific types of fuel be sold in an area can lead to fewer refineries supplying the market and increased wholesale prices.⁶⁰

It is unknown whether RFG requirements in Kentucky affect competition and prices. In May 2015, Kentucky's attorney general filed suit against Marathon Petroleum Co. The suit indicates that Marathon Oil accounts for 90 to 95 percent of the RFG market in Louisville and Northern Kentucky, allowing the company to charge higher prices than it would otherwise.⁶¹

The Energy Information Administration estimates that RFG reduces fuel economy by 1 percent to 2 percent.

Consumers may also observe reduced fuel economy when using RFG. In 2000, the US Energy Information Administration reported that RFG reduced fuel efficiency by 1 percent to 2 percent.⁶² For example, RFG would reduce fuel economy from 25 to 24.5 or 24.75 miles per gallon. For comparison, using a car's air conditioner during a hot day reduces fuel efficiency by 21 percent.⁶³

Benefits Of Reformulated Gasoline

Most research examines the effect of ozone exposure on health rather than the benefits of RFG as compared to conventional gasoline. Results have varied, but most studies of the effect of ozone on health have concluded that ozone increases the risk of death.

Effect Of Ozone On Human Health. Most of the relevant research examines how ozone affects health rather than how using RFG affects health. Researchers appear to agree that ozone is harmful, but the size of the effect varies across studies. The variation occurs partially because of differences in how the studies were conducted. For example, some studies examine the effects of ozone throughout the year; others focus on the ozone season. Some studies include the entire population; others focus on specific groups such as the elderly or children.

Ozone aggravates the functioning of the heart and lungs and can cause coughing, shortness of breath, and irritation of the eyes, nose, and throat. However, the elderly, children, and sensitive individuals may experience more significant consequences from exposure, such as an increased risk of death.

Inhaling ozone can inflame the lining of an individual's lungs, aggravating pulmonary and cardiopulmonary functions. Most individuals experience mild symptoms including shortness of breath, coughing, and irritation of the nose, eyes, and throat. These symptoms typically appear during exposure but may persist for several days. Children, the elderly, and those with inhibited cardiopulmonary functioning may experience more significant symptoms including an increased risk of death. Intense exercise outdoors when ozone levels are heightened is not recommended

and may exaggerate reactions in an individual who is categorized as sensitive.⁶⁴

Many studies report health effects of ozone levels changing by 10 ppb. Ozone levels in the winter rarely reach levels that are considered harmful to humans or the environment. In the summer, ozone fluctuates considerably and increases of 10 ppb in ozone are common during 24-hour periods. Especially hot summer days facilitate increased ozone formation, and 8-hour ozone averages commonly jump more than 25 ppb within 48 hours.⁶⁵

According to a 2005 analysis, a 10 ppb increase in ozone led to a mean increase of 1.11 percent in cardiovascular mortality and 0.47 percent in respiratory mortality. The effect was larger for some groups.

According to a 2005 meta-analysis of 144 estimates of effects from 39 studies, a 10 ppb increase in ozone led to a mean increase of 1.11 percent in cardiovascular mortality and 0.47 percent in respiratory mortality. The effect was larger for some groups. A 10 ppb increase in daily ozone increased mortality among the elderly by 1.45 percent on average.⁶⁶ According to a 2008 study, African Americans were 0.53 percent more likely to die because of a 10 ppb increase in daily ozone than were others, and women were 0.58 percent more likely to die than men.⁶⁷

Elevated ozone concentrations have been linked to increased inhaler usage and emergency room visits and an increased likelihood of missing school.

High ozone levels can also affect inhaler usage and emergency room visits. A 1996 study concluded that a 25 ppb increase in ozone increased inhaler usage among children in San Diego by 26 percent and increased the severity of self-assessed symptoms by 25 percent.⁶⁸ A 1992 study indicated that “between 13 and 15 percent of the variability of ... asthma visits was explained by temperature and ambient ozone levels.”⁶⁹ A group of Canadian researchers found that asthma-related emergency department visits were 33 percent higher when the ozone level was greater than 75 ppb.⁷⁰ A 2012 study estimated that students in the US would have missed 1 million fewer school days per year had permissible ozone levels been 75 ppb from 2005 to 2007.⁷¹

RFG emissions contain fewer cancer-causing agents than conventional gasoline.

Two studies examined the direct effect of RFG on health. The Northeast States for Coordinated Air Use Management found that “Phase I federal reformulated gasoline ... served to reduce the cancer risk associated with gasoline vapors and automobile exhaust compared to conventional gasoline by 12 percent.” Although Phase II gasoline had not been implemented at the time of the study, the analysis predicted that “Phase II federal reformulated gasoline is expected to further reduce the public cancer risk from exposure to gasoline vapors ... by 20 percent.”⁷² California’s Air Resources Board estimated that the state’s new “cleaner-burning gasoline will reduce human cancer risk related to gasoline exposure by 30 to 40 percent.”⁷³

Ozone damage is estimated to decrease the value of crop yields by billions of dollars per year.

Effect Of Ozone On Environmental Health. Ground-level ozone also affects vegetation. Ozone inhibits the growth of plants by affecting photosynthesis.⁷⁴ A group of Princeton University researchers estimated that the value of global crop yields was reduced by \$11 billion to \$18 billion because of ozone toxicity in 2000. The largest yield reductions come from soybeans, wheat, and corn. In 2000, the “global yield reductions ranged ... from 8.5-14% for soybean, 3.9-15% for wheat, and 2.2-5.5% for” corn.⁷⁵ Another study provided a larger estimate of the value of global crop loss in 2000 of \$14 billion to \$26 billion.⁷⁶ The Princeton researchers predicted that global crop yield reductions will increase to \$17 billion to \$35 billion annually by 2030 given the current trend in ozone.⁷⁷

Another study quantified the damage done to crops from ozone formed by vehicle emissions only. Given the results of empirical estimation, “benefits to the agricultural sector from completely eliminating ozone-precursor emissions from motor vehicles ranges between \$3.5 and \$6.1 billion annually” in the United States. According to the authors, “most studies of the economic impact of air pollution on agriculture have found that a 25% reduction in ambient ozone would provide benefits of at least \$1-\$2 billion annually in the United States.”⁷⁸

Appendix A

History Of Kentucky And US Motor Fuel Taxes

History Of Kentucky's Motor Fuel Taxes

1920	1-cent-per-gallon excise tax levied on gasoline
1926	Tax increased to 5 cents per gallon
1945	State constitution is amended to direct all money derived from excise and license taxes, and fees on motor fuels and vehicles, to be used for administration, obligations, construction, maintenance, and repair of public highways including expenses of enforcing state traffic and motor vehicle laws
1948 Regular Session, HB 195	<ul style="list-style-type: none">• Gasoline excise tax raised from 5 to 7 cents per gallon.• 2 cents dedicated to improving rural and secondary roads
1952 Regular Session, HB 271	7-cent-per-gallon excise tax levied on special fuels
1956 2 nd Extraordinary Session, HB 8	2-cent surtax placed on trucks with more than 3 axles
1958	Surtax extended to trucks with 3 axles
1972 Regular Session, HB 336	<ul style="list-style-type: none">• Kentucky's excise tax increased to 9 cents per gallon• 0.5 cent of tax dedicated to urban roads and streets
1980 Regular Session, HB 973	<ul style="list-style-type: none">• Excise tax on gasoline and special fuels and surtax applied to trucks are amended to reflect changes in average wholesale price (AWP) of fuel• Tax rate set at 9 percent of AWP• Surtax set at 2 percent of AWP• Minimum AWP set at \$1.00 per gallon• AWP set at \$1.50 per gallon through FY 1982• Changes in AWP are limited to 10 percent of the AWP at close of previous fiscal year• Floor stocks tax enacted to capture additional tax or credit due to increases or decreases in quarterly tax rate
1982 Regular Session, HB 478, HB 594, HB 810	<ul style="list-style-type: none">• Minimum AWP increased to \$1.11• Weight distance tax imposed at 2.85 cents per mile for trucks over 59,999 pounds

1986 Regular Session, HB 126	<ul style="list-style-type: none"> • Supplemental highway user tax enacted • Supplemental highway user tax rate set at 5 cents for gasoline and 2 cents for special fuels • Differential rates for surtax enacted. Surtax remains at 2 percent for gasoline, but increases to 4.7 percent for special fuels
1988 Regular Session, HB 665	Additional weight distance tax imposed at 1.5 cents per mile for a limited time
2005 Regular Session, HB 267 Part XVII	<ul style="list-style-type: none"> • Minimum AWP raised to \$1.22 • 1 cent of tax collected is excluded prior to the allocations required under KRS 177.320 and 177.365
2006 Regular Session, HB 380 Part XVIII	<ul style="list-style-type: none"> • Minimum AWP raised to \$1.342 per gallon • 2.1 cents excluded prior to the allocation required under KRS 177.320 and 177.365
2009 Regular Session, HB 374	Minimum AWP raised to \$1.786 per gallon
2015 Regular Session, HB 299	<ul style="list-style-type: none"> • Minimum AWP raised to \$2.177 • AWP used to calculate tax rate per gallon is frozen for fourth quarter of FY 2015 and for each quarter in FY 2016 • Beginning in 2017, AWP used to calculate variable rate will be based on average of previous four quarters • Beginning in 2017, changes in AWP are limited to 10 percent increase or 10 percent decline

Sources: Carroll, John D. *The Kentucky Statutes*. Sixth ed. Louisville: Baldwin Law Book Company, 1922; Kentucky. Dept. of Revenue. *Annual Report 1975-1976* and "Forty Years of Tax Administration 1936-1976"; Kentucky. Legislative Research Commission. Appropriations and Review Committee staff.

Federal Motor Fuels Taxes (Cents Per Gallon)

Year	Gasoline	Diesel
1932	1.0	1.0
1940	1.5	1.5
1951	2.0	2.0
1956	3.0	3.0
1959	4.0	4.0
1983	9.0	9.0
1984		15.0
1987		15.1
1990	14.1	20.1
1993	18.4	24.4
1995		24.4
1996		24.3
1997		24.4

Source: United States. Internal Revenue Service. Gasoline Excise Taxes, 1933-2000. Feb. 2001. Web. Nov. 24, 2015.

Appendix B

Motor Fuel Taxes In Kentucky And Surrounding States

This appendix provides a brief description of the motor fuels taxes for gasoline and diesel fuel in states that border Kentucky. The motor fuel tax rates for gasoline and diesel in each state is ranked relative to the tax rates for all states.

Gasoline And Diesel Taxes In Kentucky And Surrounding States (In Order Of Highest To Lowest)

State	Cents Per Gallon	Comparison To Kentucky		Rank Among 50 States
		Cents Higher	Cents Lower	
Gasoline				
1 West Virginia	34.6	8.6		6
2 Illinois	34.1	8.1		9
3 Indiana	32.4	6.4		13
4 Ohio*	28.0	2.0		23
5 Kentucky	26.0	---	---	28
6 Tennessee*	21.4		4.6	38
7 Missouri*	17.3		8.7	45
8 Virginia	16.8		9.2	47
Diesel				
1 Illinois	36.6	13.6		5
2 West Virginia	34.6	11.6		7
3 Indiana	30.16	7.16		19
4 Ohio*	28.0	5.0		25
5 Kentucky	23.0	---	---	35
6 Virginia	20.8		2.2	40
7 Tennessee*	18.4		4.6	44
8 Missouri*	17.3		5.7	47

*Fixed rate; other states are variable rate.

Sources: American Petroleum Institute. Motor Fuel Taxes: Notes Summary. Oct. 1, 2015. Web. Nov. 16, 2015; US. Energy Information Administration. Monthly Gasoline and Diesel Fuel Update. Federal and State Motor Fuel Taxes. July 1, 2015. Web. Nov. 11, 2015; Federation of Tax Administrators. State Motor Fuel Tax Rates. Jan 1, 2015. Web. Nov. 16, 2015.

Illinois (Effective date of excise tax: 1990)

The gasoline excise tax is 19 cents per gallon; the diesel excise tax is 21.5 cents per gallon. Illinois also levies a 1.1-cent-per-gallon environmental impact and underground storage tank assessment fee. Motor fuel sales are subject to the state and local sales tax, and local excise taxes may apply.

The state sales tax is 6.25 percent; local sales tax rates can add an additional 3.5 percent. Unlike other states that apply a sales tax to motor fuels, Illinois calculates the state sales tax after federal taxes are applied. The sales tax is prepaid monthly, and the rate is determined every 6 months. For July 1 to December 31, 2015, the prepaid sales tax rate is 14 cents per gallon.

Illinois permits local excise taxes on fuel. For example, Cook County imposes a 6-cent-per-gallon local tax on gasoline; and Chicago imposes an additional 5-cent-per-gallon tax. Thus, in Chicago the local excise tax for gasoline is 11 cents per gallon. DuPage, Kane, and McHenry Counties impose a 4-cent-per-gallon local excise tax on motor fuels. Under Illinois statutes, any city with a population of more than 100,000 may impose a motor fuel tax of 1 cent per gallon by referendum.⁷⁹

Indiana (Effective date of excise tax: 2003)

The gasoline excise tax is 18 cents per gallon. The diesel excise tax is 16 cents per gallon. Indiana—similar to Tennessee and Kentucky—is one of nine states that have a lower diesel excise tax than the excise tax rate on gasoline.

Fuel sales are subject to the state sales tax. Prior to July 1, 2014, Indiana collected a 7 percent state sales tax at the retail level on fuel sales on a prepaid basis. The retail sales tax on gasoline was replaced by a 7 percent wholesale gasoline sales tax on July 1, 2014. The wholesale gasoline tax is based on the average wholesale price from the previous month, resulting in monthly variations in Indiana's gasoline tax. The 7 percent sales tax on diesel for non-tax-exempt trucks is collected at the retail level.^u Indiana also has a 1-cent-per-gallon inspection fee.⁸⁰

Missouri (Effective date of excise tax: 1996)

The fixed-rate gasoline tax was last changed in 1996. The excise tax rate is 17 cents per gallon for gasoline and diesel. The sale of motor fuels is not included in the state sales tax base, and local excise or local sales tax are not applied. Two additional fees are imposed on a per-gallon basis on motor fuel sales. The agricultural inspection fee is 0.05 cents per gallon, and the transport load fee is 0.25 cents per gallon.

Missouri distributes 10 percent of its motor fuels tax to counties (50 percent based on county road mileage and 50 percent based on rural land valuation), 15 percent to cities (population based), and 75 percent to the state road fund.⁸¹

^u Fuel purchases by commercial trucks in Indiana are exempt from the state sales tax, but pay an 11-cent-per-gallon commercial motor carrier surcharge.

Ohio (Effective date of excise tax: 2005)

The fixed-rate motor fuels excise tax is 28 cents per gallon for gasoline and diesel. Motor fuels are not subject to state or local sales taxes, and there are no local motor fuel excise tax rates.

Ohio's motor fuel tax is made up of five levies. The total rate includes one levy of 8 cents per gallon, two levies of 2 cents each, one levy of 1 cent, and the largest levy, 15 cents per gallon, which was once variable.^v Unlike 30 other states, Ohio does not levy an environmental assessment or leaking underground storage fee.

School districts can obtain a refund for motor fuel taxes paid above 22 cents per gallon. Ohio has certain statutory dedications that are made before motor fuel revenues are distributed to cities, counties, and the state. After the dedicated allocations are made, 70.2 percent of motor fuel receipts are distributed to the state and 29.8 percent are distributed to municipal corporations, counties, and townships.

Ohio imposes an additional tax on petroleum suppliers. Prior to July 1, 2014, Ohio imposed a commercial activity tax of 0.26 percent on the gross receipts of petroleum suppliers. On July 1, 2014, the tax rate increased to 0.65 percent of gross receipts. This tax is now known as the motor fuel supplier tax or petroleum activity tax. It is calculated quarterly and is based on gross receipts, which are determined by multiplying gallons sold by the average wholesale price. The average wholesale price used to determine gross receipts in a quarter is based on the average wholesale price from two quarters before.⁸²

Tennessee (Effective date of excise tax: 1990)

The gasoline excise tax is 20 cents per gallon. The diesel excise tax is 17 cents per gallon. The gasoline tax was last increased in 1989. The diesel tax was last increased in 1990. Tennessee, like Kentucky and seven other states, has a lower diesel excise tax rate than gasoline excise tax rate.

In addition to the gasoline and diesel excise tax, a special petroleum fee of 1 cent per gallon and an environmental assurance fee of 0.4 cents per gallon are imposed on motor fuel sales.

Motor fuel sales are not subject to state or local sales taxes. A statutory provision provides for a limited local motor fuel excise tax. Cities and counties may levy a 1-cent-per-gallon tax for public transit, subject to voter approval. No entity has adopted a local motor fuel excise tax. Thirty-seven percent (7.9 cents per gallon) of the motor fuel tax is distributed to cities and counties.⁸³

^v Prior to 1993, Ohio's largest motor fuels levy was adjusted annually for inflation. In 1991, Ohio imposed a 3-cent-per-gallon surtax on common carriers. This surtax was reduced to 2 cents per gallon in 2003 and was repealed in 2005 when Ohio's excise tax rate increased from 26 to 28 cents per gallon

Virginia (Effective date of excise tax: N/A)^w

For gasoline, the excise tax is 5.1 percent of the average wholesale price. For diesel, the excise tax is 6 percent of the average wholesale price. The minimum average wholesale price for gasoline is \$3.17, and the minimum price for diesel is \$3.36. Current excise tax rates are 16.2 cents per gallon for gasoline and 20.2 cents per gallon for diesel.^x These are the minimum rates allowed. The motor fuel tax rates have been at the minimum in 2015 because fuel prices have remained below the statutory minimum level. Virginia also has a 0.6-cent-per-gallon petroleum storage fee.

Adjustments to the variable-rate excise tax in Virginia are made twice each year. The January 1 adjustment is based on average wholesale price from June 1 to November 1. The July 1 adjustment is based on average wholesale price from December 1 to June 1.

The sales tax does not apply to motor fuel sales. In 2013, Virginia raised its sales tax rate from 5 percent to 5.3 percent. The additional sales tax revenue from the 0.3 percent rate increase is dedicated to transportation projects. Local option taxes are allowed.^{y 84}

West Virginia (Effective date of excise tax: 1993)

The motor fuel tax has a fixed and a variable component. The fixed component is a 20.5-cent-per-gallon excise tax applied to gasoline and diesel fuel sales. The variable component is the motor vehicle fuel sales tax that is collected at the wholesale level.

The motor vehicle fuels sales tax rate is 5 percent of the average wholesale price.^z The average wholesale price floor is \$2.34 per gallon (minimum motor vehicle fuel sales tax is 11.7 cents per gallon). The motor vehicle fuel sales tax rate is adjusted on January 1 each year based on the July-October average wholesale price data from the previous calendar year. The annual change in the average wholesale price is limited to plus or minus 10 percent when compared to the average wholesale price in the previous year.⁸⁵

^w In 2013, Virginia removed its 17.5-cent-per-gallon excise tax and replaced it with a variable-rate tax.

^x Virginia drivers of certain diesel vehicles (passenger cars, pickup and panel trucks, and other vehicles with a gross vehicle weight rating of 10,000 pounds or less) can request a refund equal to the difference between the gasoline and diesel excise tax rates.

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