RESEARCH

Report No. UT-15.06

IMPACT OF HIGH EFFICIENCY VEHICLES ON FUTURE FUEL TAX REVENUES IN UTAH

Prepared For:

Utah Department of Transportation
Research Division

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Final Report
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UDOT Keeping Utah Moving
Utah Department of Transportation - Research Division
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16. Abstract

The Utah Department of Transportation Research Division has analyzed the potential impact of high-efficiency motor vehicles on future State of Utah motor fuel tax revenues used to construct and maintain the highway network. High-efficiency motor vehicle use (including electric, hybrid, CNG, and other alternative fuel vehicles) is on the rise in Utah. New light duty vehicles with standard gasoline-powered engines are more efficient to comply with adopted Corporate Average Fuel Economy (CAFE) standards. As the motor vehicle fleet in Utah becomes more efficient, using less gasoline per mile traveled, there is a potential for a significant slowing in the growth, or a reduction, of revenue from this source.

This research project developed three scenarios for understanding how a variety of factors could combine to affect future fuel tax revenues in Utah. The time horizon of the analysis is 2040. To estimate the effect of high efficiency vehicles on future fuel tax revenues, the FHWA Energy and Emissions Reduction Policy (EERPAT) Analysis Tool was used. EERPAT was parameterized and calibrated to 2010 conditions in Utah, and used to estimate future transportation conditions such as VMT, fleet mix, fuel choice, fuel consumption, and fuel tax revenues.

Future demographic, travel, and income projections, obtained from State of Utah data sources, were used as inputs to the analysis. Key driving assumptions include: 1) future fuel efficiency of heavy duty vehicles; 2) future market penetration of CNG for heavy duty vehicles; 3) future market penetration of alternative drive train vehicles – battery electric, plug-in hybrid, and hybrid – into the light duty vehicle fleet; and, 4) future motor fuel tax rates.

The analysis shows that, even with a growing population and increasing VMT, total fuel tax revenues are projected to decline by 29% in constant 2015 dollars when compared to 2010. Assuming very modest penetration of alternative drive train vehicles (hybrid, plug-in hybrid, battery electric) in the Base Case (<1%/year), total revenues decline due to higher efficiency of light duty vehicles, high penetration of CNG in the heavy-duty vehicle fleet, and erosion of the purchasing power of the gasoline tax (0.245 in 2015$) due to inflation.

Assuming moderate to aggressive penetration of alternative drive train vehicles in the future, overall fuel tax revenues decline even further. A moderate penetration of alternative drive train vehicles would result in a further 19% reduction from the 2040 Base Case (or, a 42% decline in constant dollar fuel tax revenues compared to 2010); an aggressive penetration of alternative drive train vehicles would result in a further 25% reduction in fuel tax revenues from the 2040 Base Case (or, a 47% decline in constant dollar fuel tax revenues compared to 2010).

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UNIT CONVERSION FACTORS

SI* (MODERN METRIC) CONVERSION FACTORS				
APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa
APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. (Adapted from FHWA report template, Revised March 2003)

LIST OF ACRONYMS

EERPAT	Energy and Emissions Reduction Policy Analysis Tool
FHWA	Federal Highway Administration
UDOT	Utah Department of Transportation

EXECUTIVE SUMMARY

The Utah Department of Transportation Research Division has analyzed the potential impact of high-efficiency motor vehicles on future State of Utah motor fuel tax revenues used to construct and maintain the highway network.

High-efficiency motor vehicle use (including electric, hybrid, CNG, and other alternative fuel vehicles) is on the rise in Utah. New light duty vehicles with standard gasoline-powered engines are more efficient to comply with adopted Corporate Average Fuel Economy (CAFE) standards. As the motor vehicle fleet in Utah becomes more efficient, using less gasoline per mile traveled, there is a potential for a significant slowing in the growth, or a reduction, of revenue from this source, decreasing the State's ability to deal with the operational and maintenance impacts associated with increasing population and travel demand.

This research project developed three scenarios for understanding how a variety of factors could combine to affect future fuel tax revenues in Utah. The time horizon of the analysis is 2040.

To estimate the effect of high efficiency vehicles on future fuel tax revenues, the FHWA Energy and Emissions Reduction Policy (EERPAT) Analysis Tool was used. EERPAT is designed to analyze transportation energy scenarios and enables the assessment of policy interactions across a variety of scenarios. EERPAT was parameterized and calibrated to 2010 conditions in Utah, and used to estimate future transportation conditions such as VMT, fleet mix, fuel choice, fuel consumption, and fuel tax revenues.

Future demographic, travel, and income projections, obtained from State of Utah data sources, were used as inputs to the analysis. Key driving assumptions include: 1) future fuel efficiency of heavy duty vehicles; 2) future market penetration of CNG for heavy duty vehicles; 3) future market penetration of alternative drive train vehicles – battery electric, plug-in hybrid, and hybrid – into the light duty vehicle fleet; and, 4) future motor fuel tax rates.

The analysis shows that, even with a growing population and increasing VMT, total fuel tax revenues are projected to decline by 29% in constant 2015 dollars when compared to 2010. Assuming very modest penetration of alternative drive train vehicles (hybrid, plug-in hybrid, battery electric) in the Base Case (<1%/year), total revenues decline due to higher efficiency of

light duty vehicles, high penetration of CNG in the heavy-duty vehicle fleet, and erosion of the purchasing power of the gasoline tax (0.245 in 2015$) due to inflation.

Assuming moderate to aggressive penetration of alternative drive train vehicles in the future, overall fuel tax revenues decline even further. A moderate penetration of alternative drive train vehicles would result in a further 19% reduction from the 2040 Base Case (or, a 42% decline in constant dollar fuel tax revenues compared to 2010); an aggressive penetration of alternative drive train vehicles would result in a further 25% reduction in fuel tax revenues from the 2040 Base Case (or, a 47% decline in constant dollar fuel tax revenues compared to 2010).

This research project concludes that, under assumptions of modest use of alternative drive train vehicles by Utah households (Base Case), this revenue source will decline by nearly 30% by 2040. Under the more likely case of moderate penetration of alternative drive train vehicles (Mid scenario), this source of revenue will decline by over 40% by 2040, in constant dollar terms.

1.0 INTRODUCTION

1.1 Problem Statement

The Utah Department of Transportation Research Division has analyzed potential impact of high-efficiency motor vehicles on future State of Utah motor fuel tax revenues used to construct and maintain the highway network.

High-efficiency motor vehicle use (including electric, hybrid, natural gas and other alternative fuel vehicles) is on the rise in Utah. New light duty vehicles with standard gasoline-powered engines are more efficient to comply with recently adopted Corporate Average Fuel Economy (CAFE) standards. As the motor vehicle fleet in Utah becomes more efficient, using less gasoline per mile traveled, there is a potential for a significant slowing in the growth, or a reduction, of revenue from this source, decreasing the State's ability to deal with the operational and maintenance impacts associated with increasing population and travel demand.

There are mileage efficiency gains anticipated for heavy-duty vehicles as well, which is critical to account for since heavy-duty vehicles consume 25% of all fuel despite accounting for less than 10% of vehicles on the road. Phase I heavy-duty vehicle standards established modest improvements in fuel efficiency to 2017. In 2015 the Phase II heavy-duty fuel efficiency standards are expected to be announced. Some analysts suggest that fuel efficiency gains of almost 40% can be obtained for heavy-duty vehicles.[1] Alternative truck fuels such as CNG will also affect overall revenues from motor fuel sales.

1.2 Objectives

This research project developed three scenarios for understanding how a variety of factors could combine to affect future fuel tax revenues in Utah. The time horizon of the analysis is 2040.

[1] See: http://www.ucsusa.org/clean-vehicles/fuel-efficiency/heavy-duty-truck-standards#.VQHwMuHG-PX

1.3 Scope

To address the research question FHWA's Energy and Emissions Policy Analysis Tool (EERPAT) was parameterized using several data sets obtained from a variety of sources for Utah for 2010.[2]

This model was calibrated to key transportation characteristics, such as:

- statewide Vehicle Miles Traveled,
- auto ownership and fleet age (from state vehicle registration data),
- fuel consumption (from HPMS and state gas tax records), and
- gasoline taxes (from the Utah Revenue Department).

Three future fuel tax revenue scenarios were developed that varied based on the market share of new light duty vehicles that are powered with alternative drive trains, i.e. hybrid electric, plug-in hybrid electric, and battery electric. A "Business as Usual" scenario posits that alternative drive train market penetration will continue at its current rate, which is less than 1% of new light duty sales per year. Two other scenarios -- a Mid-Range and a High – referring to the market share of alternative drive train vehicles, were evaluated for the overall impact on future motor fuel tax revenues.

1.4 Outline of Report

The report on this research proceeds as follows:

- Research Methods
- Data Collection for Key Model Inputs
- Analysis of Future Motor Fuel Tax Revenues
- Estimates of Future Fuel Tax Revenues in Utah
- Summary and Conclusions

[2] See: http://planning.dot.gov/FHWA_tool/

2.0 Research Methods

The FHWA Energy and Emissions Policy Analysis Tool (EERPAT) was used to address the question of future fuel tax revenues.[3] EERPAT was developed to assist state transportation agencies with analyzing transportation energy scenarios. EERPAT allows the assessment of policy interactions across a variety of scenarios. EERPAT is based on GreenSTEP, developed by the Oregon State DOT.

Statewide EERPAT models have been developed for Oregon, Florida, Washington, Colorado, Maryland, and Vermont. For the UDOT research project, a Utah version of the model was developed using input data sets for Utah. The Utah model was calibrated to key transportation characteristics, such as:

- statewide Vehicle Miles Traveled,
- auto ownership and fleet age (from state vehicle registration data),
- fuel consumption (from HPMS and state gas tax records), and
- gasoline taxes (from the Utah Revenue Department).

The model was calibrated to 2010 conditions. Comparison of model-generated estimates against calibration data is shown in Table 1.

[3] See: http://planning.dot.gov/FHWA_tool/

Calibration Item		Model Estimate	Calibration Data	Comparison	Source
2010 Vehicle Population, # of Automobiles, Light Trucks	Auto	1,313,679	**1,340,300**	-1.99%	Utah Department of Motor Vehicles, http://tax.utah.gov/esu/mv-registration/2011OnroadYearType.pdf, http://www.crcao.org/publications/atmosphereImpacts/index.html
	Light Trucks	599,425	**588,733**	1.82%	
2010 Annual Vehicle Miles Traveled, Million Vehicle Miles	Urban	17,032	**17,444**	-2.36%	HPMS, Utah Statewide Travel Demand Model
	Rural	7,413	**7,650**	-3.10%	
	Total	24,444	**25,093**	-2.59%	
Fuel Consumption, Thousands of Gallons, 2010	Total	1,390,447	**1,424,804**	-2.41%	Utah Motor Fuel Report
Fuel tax revenue, 2010	Total	340,659,624	**338,231,598**	0.72%	Utah Motor Fuel Report

Table 1: Utah EERPAT Model Calibration

For the Utah application of EERPAT, the entire State of Utah is represented on a county and/or metropolitan (as appropriate) basis in order to be responsive to regional differences. The model distinguishes between households living in metropolitan, other urban, and rural areas to reflect the different characteristics of those areas in terms of density, urban form, household income, and transportation system characteristics.

At the beginning of the modeling chain EERPAT incorporates a system of disaggregate household-level models that generates individual households with attributes including age, income, and vehicle ownership characteristics.

Because household fuel costs are a function of fuel price and household vehicle fuel economy, the model accounts for increases in travel that would occur with gains in fuel economy (rebound effect). Also, modeling at the individual household level allows for better analysis of how different households are affected by policies in a number of ways.

EERPAT is designed to run at a county and metropolitan level. This design concept was motivated by the availability of long-range population projections by age at the county level and the need for the model to be sensitive to regional differences.

Figure 1 and Figure 2 show an overview of EERPAT. The gray boxes in the middle of the figure identify the major steps in the model execution. The blue boxes on the left side of the figure show the input assumptions on which the calculations are based and which may be altered to represent different policies. The green boxes on the right side of the figure identify the models and methodologies that are used in the calculations.

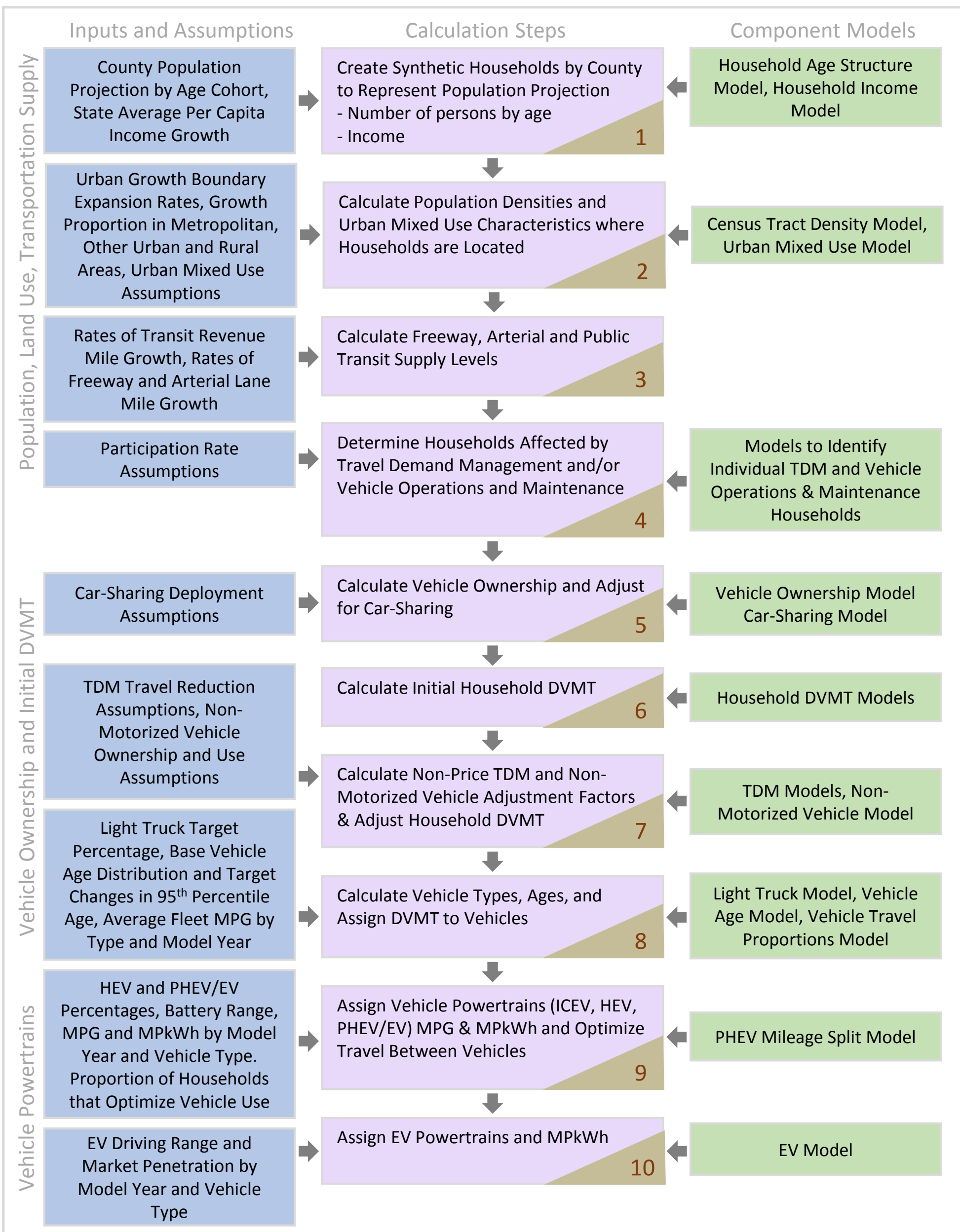


Figure 1: Design of Model for Estimating Passenger Vehicle and Truck Travel

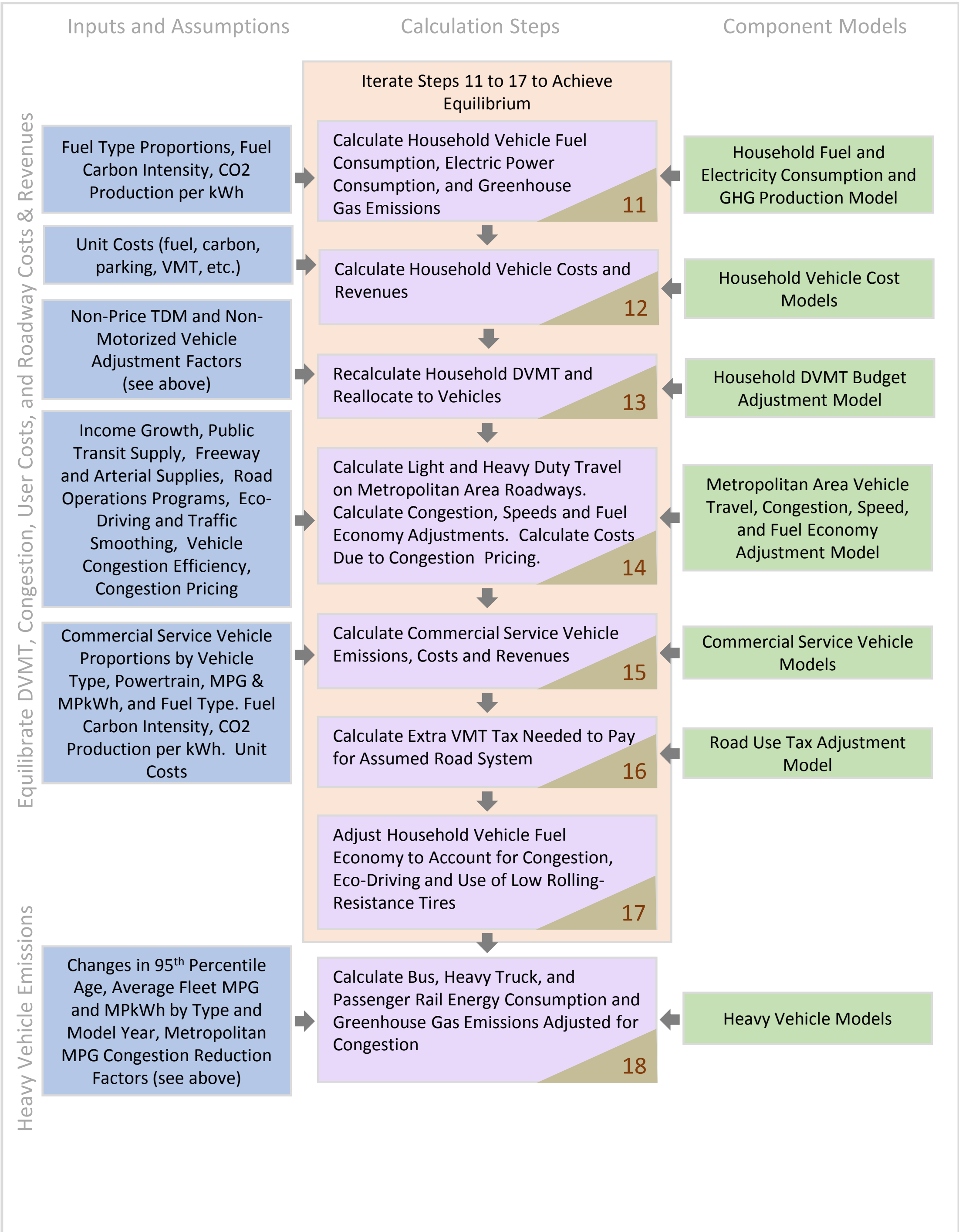


Figure 2: Design of Model for Estimating GHG from Passenger and Truck Travel (continued)

3.0 Data Collection for Key Model Inputs

EERPAT is a screening tool to compare, contrast, and analyze the effects of various transportation energy policy scenarios. EERPAT estimates the amount of travel (in terms of vehicle miles traveled) and the resulting fuel consumption and fuel tax revenues, including fuel use (and electricity use for battery charging) by autos, light trucks, transit vehicles, and heavy-duty vehicles.

For this research project, EERPAT required the development of several input data sets, including:

- Changes in population demographics (age structure);
- Changes in personal income;
- Relative amounts of development occurring in metropolitan, other urban, and rural areas;
- Metropolitan, other urban, and rural area densities;
- Urban form in metropolitan areas (proportion of population living in mixed-use areas with a well interconnected street and walkway system);
- Amounts of metropolitan area transit service;
- Metropolitan freeway and arterial supplies;
- Auto and light truck proportions by year;
- Average vehicle fuel economy by vehicle type and year;
- Vehicle age distribution by vehicle type;
- Internal Combustion Engine vehicles (ICEV), Hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), and full electric vehicles (EV) by vehicle type and year;
- Pricing – fuel cost and gasoline tax;

Figure 3 shows the population and household projections used in this analysis.

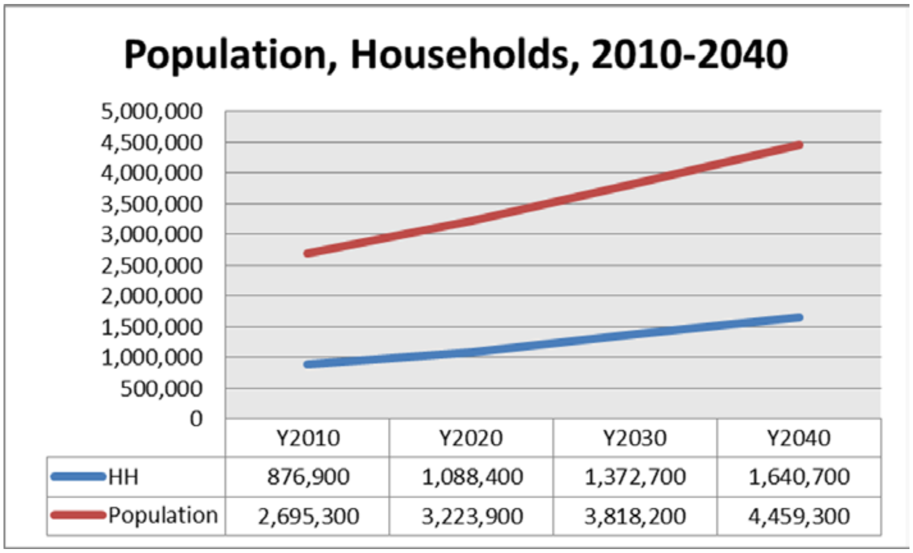


Figure 3: Utah Population and Household Numbers, 2010-2040 (Source: Governor's Office of Planning and Budget, 2012 Baseline Projections)

Within the model, population and household data are further subdivided into county and metropolitan geographies. Also, households are synthesized to match key household attributes, including household size and age characteristics.

Figure 4 shows projections for per capita income in Utah, 2010-2040 (2015$). Real annual growth in per capita income is assumed to be 1.36%, which is the real growth rate of per capita income in Utah for the 1990-2010 period.

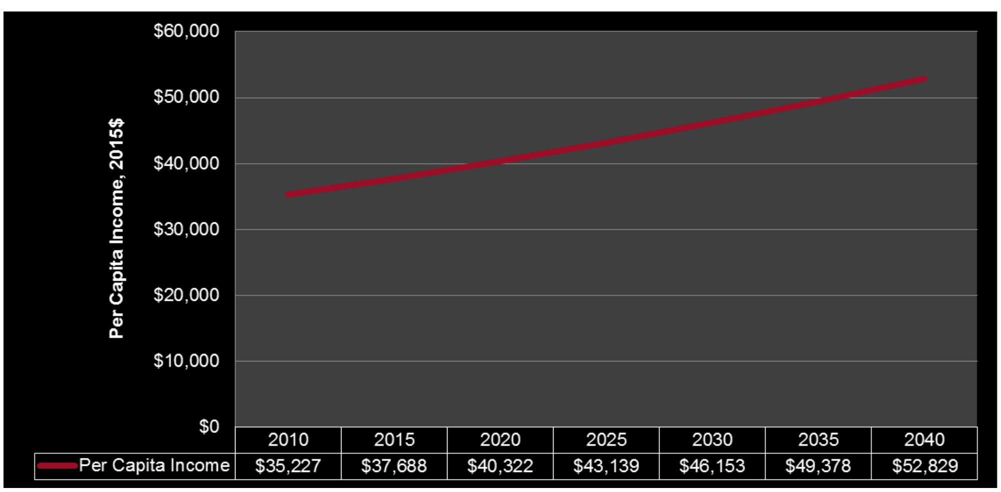


Figure 4: Per Capita Income Projection, 2010-2040 (2015$)(Source: Bureau of Economic Analysis)

Within EERPAT, statewide per capita income is converted to regional per capita income based on regional income differences. Household income is then estimated using a regression model based on the number and ages of people in each household and from the per capita income for the region in which the household lives. Income has multiple impacts in the model:

- Vehicle ownership per household;
- Potential for trips to be diverted to non-motorized modes;
- Probability that a household will have an automobile or light truck;
- Vehicle age;
- Plug-in hybrid and electric vehicle usage-used as a scenario variable in this analysis.

All else equal, higher income results in higher VMT. Higher incomes also have the effect of reducing household sensitivity to pricing policies. Offsetting these dynamics is the relationship where higher income households tend to own newer model vehicles, which are more fuel efficient.

Another driving force in the model involves fuel economy. For light-duty vehicles (automobiles and light trucks, including SUVs), the CAFÉ standards establish average fleet mileage efficiencies for vehicles by model year to 2025. The CAFÉ standards provide an upper end for efficiency, with an "effective" fuel economy being a more accurate measure of efficiency under actual operating conditions.

Both the adopted CAFÉ standards and the effective fuel economy of new vehicles are shown in Figure 5. The effective fuel economy relates to the fuel economy experienced by vehicles in real world (as opposed to lab-tested) conditions. The effective fuel economy accounts for the fuel economy impacts of heating/air conditioning, on-road operating conditions, and a host of other factors. For this study, the effective fuel efficiency for light duty vehicles is assumed.[4]

[4] See: http://www.nytimes.com/2015/02/24/business/energy-environment/epa-issues-stiffer-rules-on-vehicle-fuel-ratings.html?ref=science&_r=0

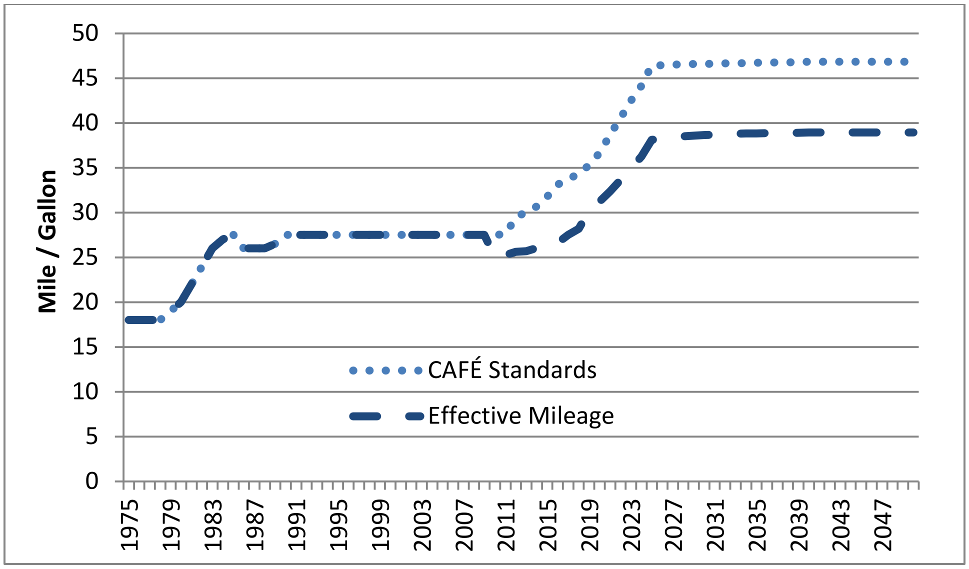


Figure 5: Forecast changes in Average Fleet Efficiency for new Light vehicles, by Year (CAFE Standards and Effective Mileage)[5]

Higher fuel efficiency lowers the overall cost of travel, and lowers fuel tax revenues. However, lower travel costs, all else equal, can exert upward pressure on VMT. The leveling off of fuel economy at 2025 levels reflects the period of the currently adopted CAFÉ standards. Beyond 2025, increasing penetration of alternative drive train vehicles – hybrid, plug-in hybrid, battery electric – are generally assumed to generate further fleet efficiency.

Figure 6 shows the demographic information previously presented and also shows the Base Case estimate of Vehicle Miles Traveled (VMT) for Utah. The VMT estimate in

Figure 6 is from the Utah EERPAT model. The model was calibrated to the VMT estimates from the HPMS for 2010, and against projections from the Utah Statewide Travel Demand Model for future years.

[5] Source: 2014 Annual Energy Outlook, Table 5. See footnote 5, which relates to the tested new vehicle efficiency for on-road performance.

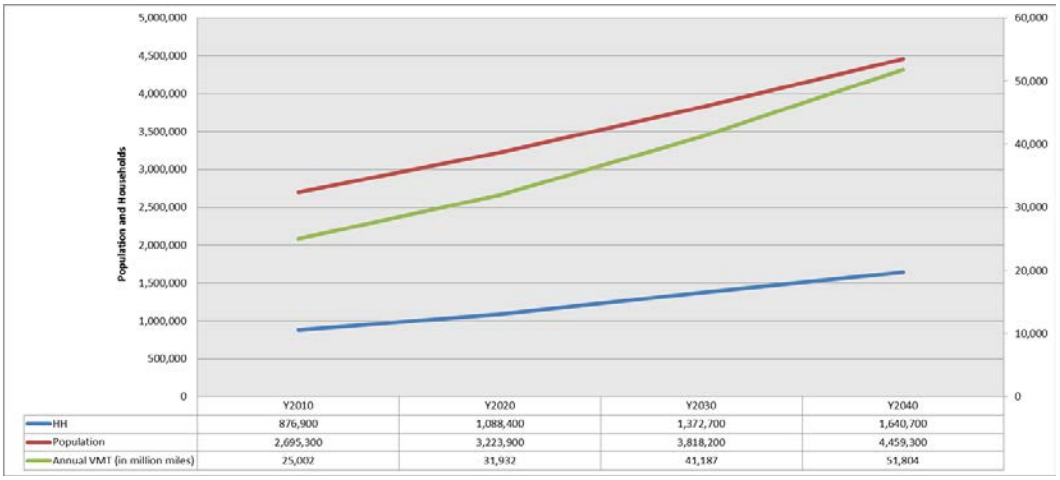


Figure 6: Future Projected Vehicle Miles Traveled for Utah, 2010-2040

The VMT estimates combined with the fuel efficiency assumptions (Figure 5) provide part of the analysis necessary for calculating future fuel tax revenues. Heavy-duty vehicle efficiency is also critical in the analysis. As mentioned previously, Phase II heavy-duty vehicle fuel efficiency standards are to be announced in March 2015. At this time, there is very little information on what these standards will look like. This research study has assumed an increase in heavy-duty vehicle fuel economy of approximately 2% annually, 2010-2040 (Figure 7).

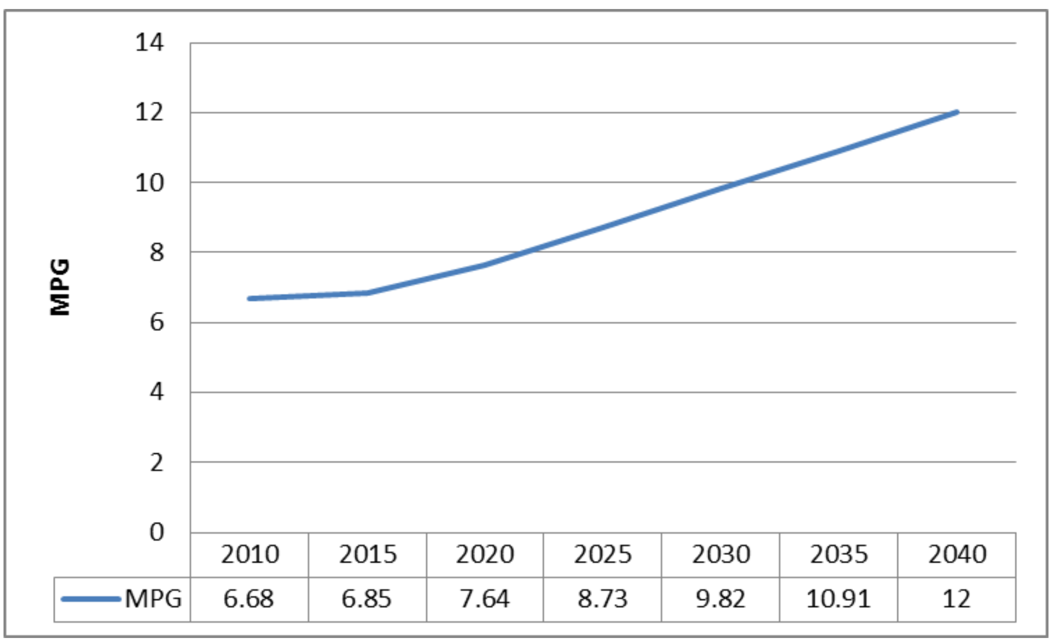
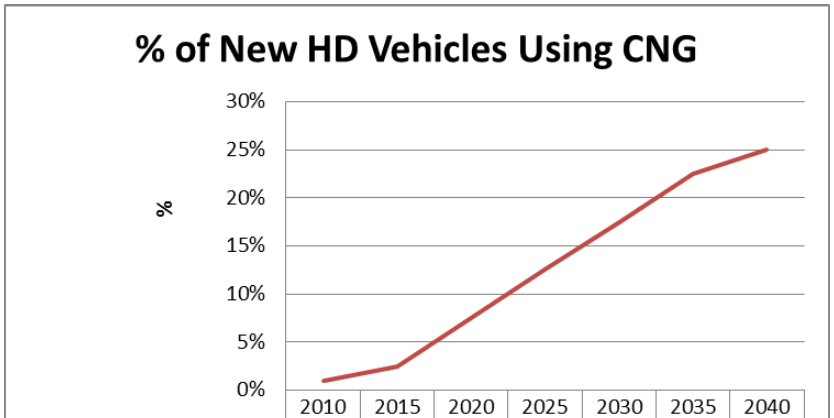


Figure 7: Assumed New Heavy-duty Fuel Economy, 2010-2040

A final key assumption affect heavy-duty vehicle fuel purchases, and fuel tax payments, relates to fuel type. Many studies project increasing use of CNG for heavy-duty and commercial service vehicles. This research project assumes growing market penetration for heavy-duty vehicles, commercial service vehicles as shown in Figure 8.



	2010	2015	2020	2025	2030	2035	2040
% of Heavy Duty Vehicles Using CNG	1%	3%	8%	13%	18%	23%	25%

Figure 8: Assumed % of New Heavy-duty Vehicles Using CNG, 2010-2040 (Source: Michael Gallagher, Presentation at DOE EIA 2013 Energy Conference)

The socio-economic and technology relationships described above (Figure 3 - Figure 8 are in effect in all runs of the Utah EERPAT model.

One of the significant implications of higher CNG use by heavy-duty vehicles is that, on a gallon-of-gas equivalent basis, CNG fuel is taxed at 35% of diesel (8.5 cents/gallon for CNG as compared to 24.5 cents per gallon for diesel.

4.0 Analysis of Future Fuel Tax Revenues

Future fuel tax revenue scenarios were developed that incorporate the input assumptions described above, and that also include varying assumptions regarding the market share of new light duty vehicles that are powered with alternative drive trains, i.e. hybrid electric, plug-in hybrid electric, and battery electric.

As mentioned previously, there is general agreement that further increases in corporate average fuel efficiency standards beyond 2025 will be substantially achieved through the sale of alternative drive train vehicles.

Two future scenarios were developed, representing different market penetration of alternative drive train vehicles: a Mid-Range scenario and a High scenario. Each scenario is compared against a Base Case, which maintains the current market share for alternative vehicles (~1%) as a basis for comparison.

Figure 9 shows the assumptions for market penetration of battery electric vehicles for the Base Case, Mid and High scenarios.

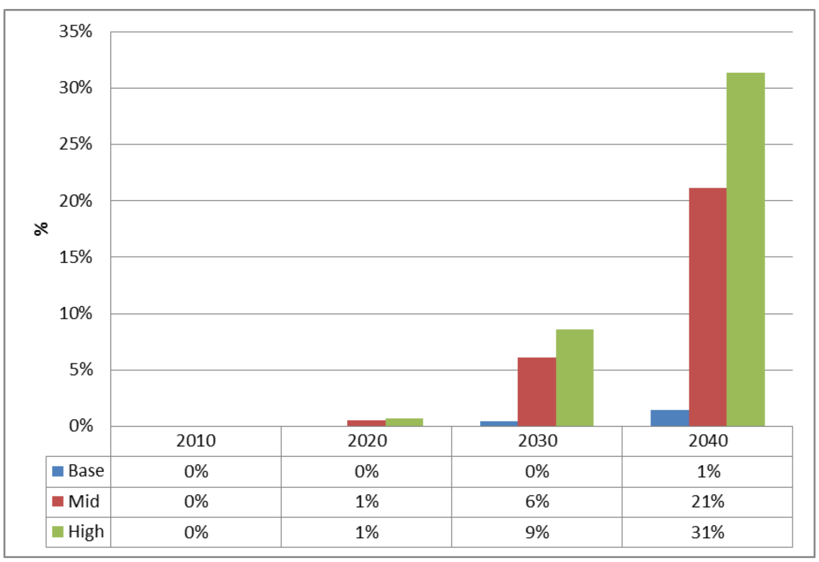


Figure 9: Battery Electric Vehicle Share of Total Passenger Vehicle Fleet, Base, Mid, and High Scenarios

Other alternative drive train vehicles include hybrid electric vehicles and plug-in hybrid electric vehicles. These vehicle types are a bridge technology to full battery electric vehicles. Nevertheless, as households purchase these vehicles, the vehicles remain in the fleet for 10-15 years, creating a longer-term impact on overall fleet efficiency.

Figure 10 shows the combined penetration of alternative drive train vehicles – hybrid, plug-in hybrid, plus battery electric – relative to conventional vehicles (internal combustion engines), assumed for the Base Case, Mid and High Scenarios. By 2040, alternative drive train vehicles comprise 5% of the vehicle fleet in the Base Case, 57% of the vehicle fleet in the Mid scenario, and 75% of the vehicle fleet in the High scenario.

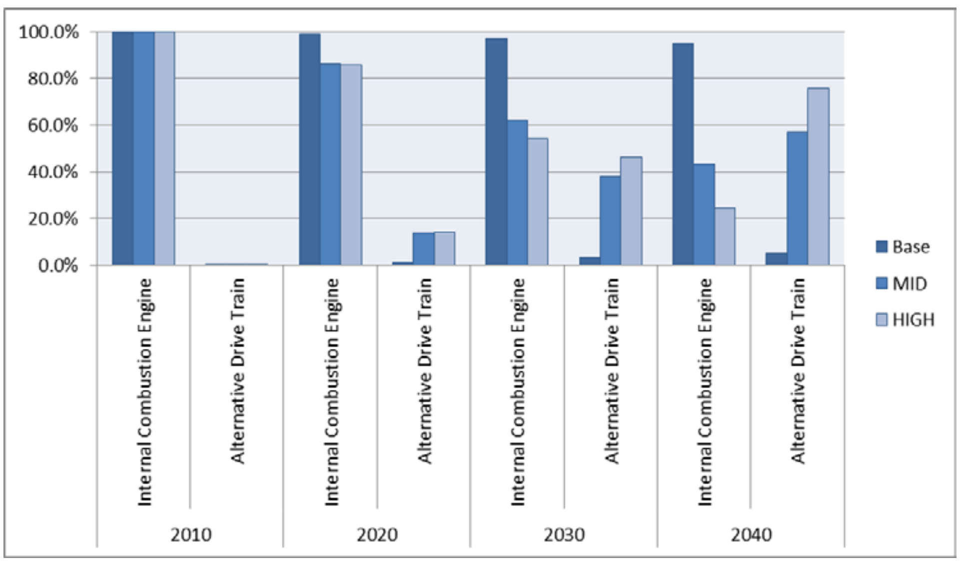


Figure 10: Alternative Drive Train vs Internal Combustion Engine Share of the Utah Vehicle Fleet, Base Case, Mid and High Scenarios

5.0 Estimates of Future Fuel Tax Revenues in Utah

The 3 scenarios described above – Base Case, Mid and High -- were simulated in the Utah EERPAT model to generate estimates of future fuel tax revenues. Fuel taxes are levied for each gallon of gasoline or diesel (special fuel) purchased, as well as for each gallon-of-gas equivalent of CNG purchased.

Current state fuel tax rates are 24.5 cents per gallon for gasoline and diesel, and 8.5 cents per gallon-of-gas equivalent for CNG. The analysis assumes no increase in the gas tax over the forecast time horizon. Figure 11 shows the decline in real value of this tax rate, assuming an average annual inflation rate of 1.7%.

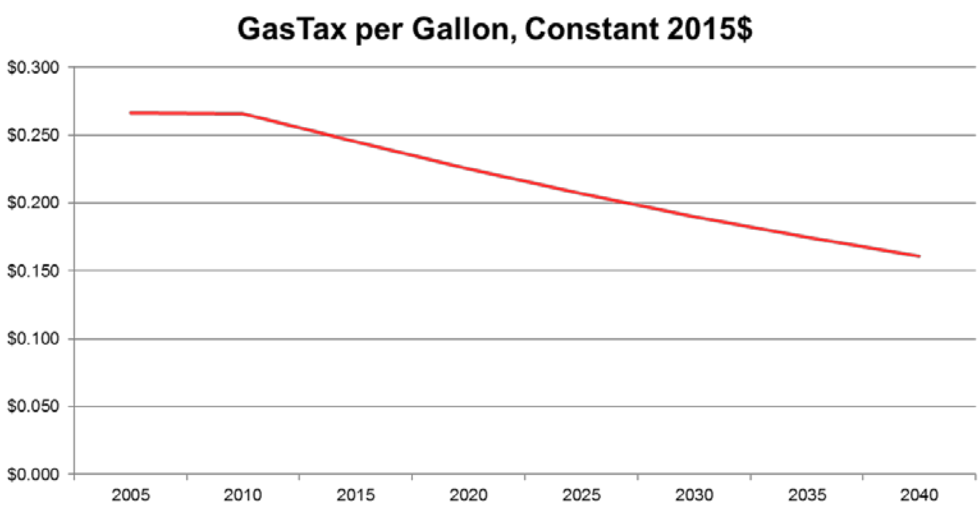


Figure 11: Gas Tax per gallon, 2015$

Actual Gas and CNG sales associated with each scenario are shown in Figure 12. The figure shows a comparison of 2010 against 2040 sales for each scenario -- Base Case, Mid and High. Note that the assumption of CNG sales for heavy-duty and commercial service vehicles is identical for each scenario. As mentioned this is an important assumption as the CNG fuel tax rate is approximately 35% of the gas tax rate.

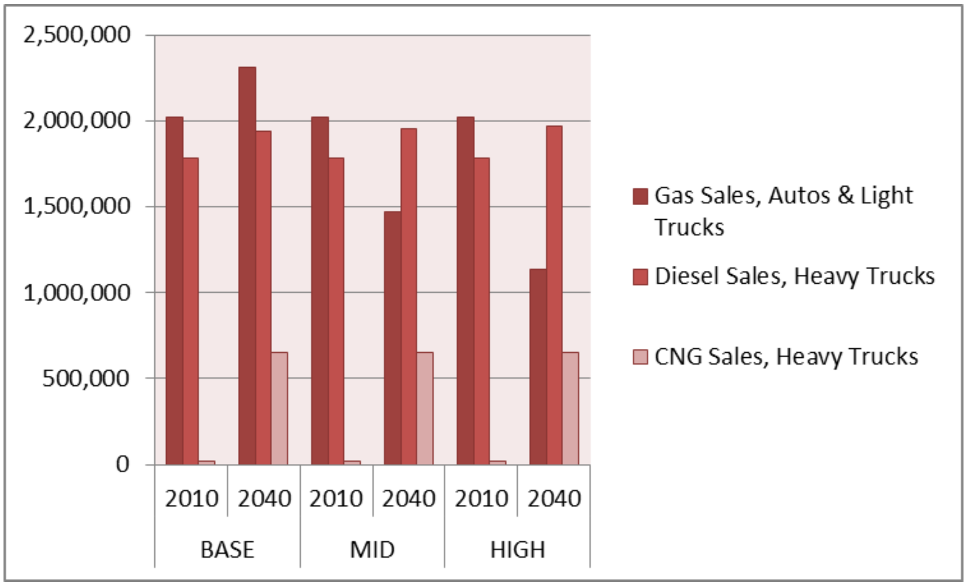


Figure 12: Projected Gas, Diesel, and CNG Sales for Light- and Heavy-Duty Vehicles, Base Case, Mid and High Scenarios

Figure 12 shows that the major changes projected across each scenario relate to the sales of gasoline for autos and light trucks. This follows directly from the market penetration of alternative drive train vehicles for light-duty vehicles purchased by households. Diesel sales and CNG sales for heavy-duty vehicles are identical across the 3 scenarios.

The foregoing inputs and analysis lead to projections of state fuel tax revenues for Utah, 2010-2040, shown in Figure 13. These data are in constant 2015$.

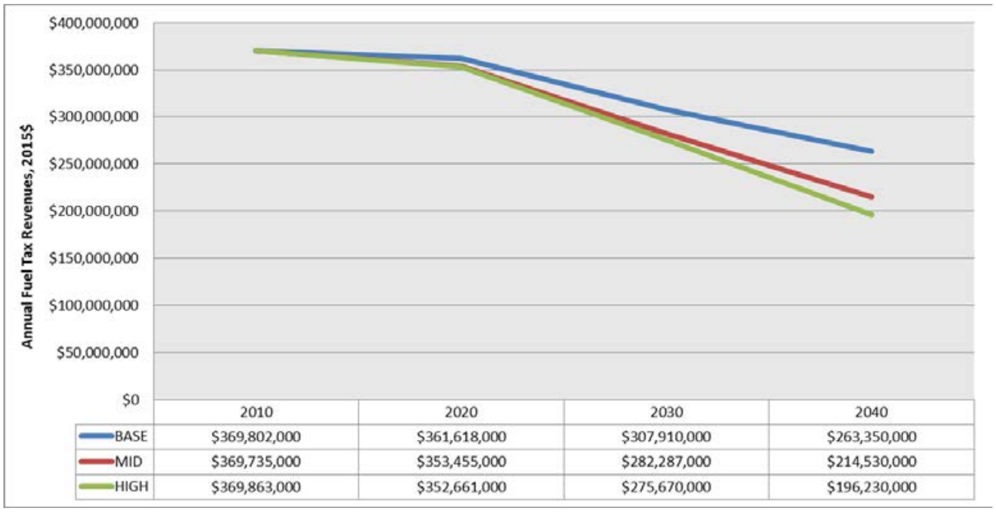


Figure 13: Projected Annual Fuel Tax Revenues, Base Case, Mid and High Scenarios (2015$)

5.1 Summary and Conclusions

In summary, this analysis shows that, even with a growing population and increasing VMT, total fuel tax revenues are projected to decline. Assuming very modest penetration of alternative drive train vehicles (hybrid, plug-in hybrid, battery electric) in the Base Case, total revenues decline due to higher efficiency of light duty vehicles, high penetration of CNG in the heavy-duty vehicle fleet, and erosion of the purchasing power of the gasoline tax (0.245 in 2015$) due to inflation.

Assuming moderate to aggressive penetration of alternative drive train vehicles in the future, overall fuel tax revenues decline even further. A moderate penetration of alternative drive train vehicles would result in a further 19% reduction from the Base Case by 2040; an aggressive penetration of alternative drive train vehicles would result in a further 25% reduction in fuel tax revenues from the Base Case by 2040.

Table 2 shows UDOT’s revenue sources in 2015. As shown motor fuel taxes currently generate over one-quarter (27.6%) of the Department’s revenue.

UDOT Funding Sources, 2015

Transportation Fund - Motor Fuel/Special Fuel	$355,979,475	27.5%
Transportation Fund - Other	$128,905,025	10.0%
Transportation Investment Fund	$584,912,907	45.2%
Transfer from Transportation Fund to TIF	-$82,633,600	-6.4%
Federal	$307,500,000	23.8%
	$ 1,294,663,807	

Table 2: UDOT Funding Sources, 2015 (Source: http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:4488,)

Motor fuel tax revenues are a very significant source of revenues for UDOT. Motor fuel tax revenues are expended in a variety of ways: UDOT operations, construction management, support and engineering services, and transfers to other agencies such as B&C Roads and the Transportation Investment Fund.

This research project concludes that, under assumptions of modest use of alternative drive train vehicles by Utah households (Base Case), this revenue source will decline by nearly 30% by 2040. Under the more likely case of moderate penetration of alternative drive train vehicles (Mid scenario), this source of revenue will decline by over 40% by 2040, in constant dollar terms.

5.2 Limitations and Challenges

The limitations and challenges of this research relate to the assumptions regarding a range of key aspects of the transportation system. The research has relied upon the most recent demographic and income projections for the state, and on the most recent transportation-related data such as statewide vehicle-miles traveled, and the private vehicle fleet age distribution.

Key assumptions regarding future fuel tax revenues have been discussed in the report, and include:

- Future gasoline price.
- Future efficiency of heavy-duty vehicles.

- Future market penetration of CNG as a heavy duty vehicle fuel.
- The market penetration of alternative drive train vehicles (battery electric, plug-in hybrid, and hybrid) into the light duty vehicle fleet, which is used in this research as a scenario variable.

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