Act 153: Section 39

Alternative Fuel Vehicle User Fee Options

Final Report

11/5/2012

Prepared for

1 National Life Drive
Montpelier, VT 05633
www.aot.state.vt.us

Submitted by

128 Lakeside Avenue, Suite 401
Burlington, VT 05401
www.veic.org

Table of Contents

1. Executive Summary

This report explores transportation infrastructure user fee options for alternative fuel vehicles in Vermont, focusing primarily on electric vehicles, but with some discussion of compressed natural gas (CNG) vehicles. While CNG used for transportation is already covered by existing Vermont law (see Section 2) we considered it in tandem with electricity because other fee systems may be of interest to policy makers. The arrival of electric vehicles on Vermont roads presents policy makers with competing goals. On the one hand there are policy goals, such as those described in the 2011 Comprehensive Energy Plan, that support and encourage adoption of electric vehicles in Vermont while on the other hand the need to continue to fund the transportation system requires some assessment of fees for all users of the system. In addition the diversity of travel behavior of urban, suburban, and rural Vermonters was considered in light of concerns regarding equity of any option to assess user fees.

The primary options explored in this report include:

1. **Flat annual registration fee on electric and CNG vehicles**: this offers administrative ease but limited equity and no opportunity for optimizing demand management. A fee of $146 would achieve approximate revenue neutrality; this is the amount an average conventional vehicle contributes annually to the state transportation fund via the gas tax.
2. **Volumetric taxes on CNG and electricity**: these fees can be assessed in two ways: a way that is revenue neutral (replaces estimated revenue derived from a conventional vehicle), or a way based on energy content (gallon gasoline equivalent, gge). A gge fee system based on $/kWh or $/cubic feet CNG may not provide revenue equivalency, although it is currently how alternative fuels such as CNG are taxed at the federal level. Revenue neutrality would require a $0.036 per kWh rate for electricity and an 18% sales tax rate or a $0.277/ccf for CNG.
3. **Vehicle miles traveled fee**: this fee is assessed to each vehicle based on the number of miles driven annually. This system offers equity to users (the more you use the road system, the more you pay), but may be administratively expensive to implement and has raised privacy concerns. A spatially explicit VMT-based system further offers opportunity to scale pricing to discourage driving in congested areas at peak times. Revenue neutrality would require a per mile VMT fee of $0.011 per mile.

The options presented were assessed according to three criteria decided upon by the Section 39 Study Group:

1. Does the option provide the state a stable revenue stream?
2. Is the option practical to implement and administer, and easy for users to understand and accept?
3. Is the option consistent with state energy and economic goals? The state energy goals that we used as assessment criteria are those laid out in the state Comprehensive Energy Plan (CEP).

There is no infrastructure funding mechanism yet in place for electric vehicles. According to DMV registration data, as of October 3 there are a total of 200 registered plug-in electric vehicles on the road in Vermont: 120 electric vehicles (including plug-in hybrid, all electric and after-market conversion vehicles), 62 neighborhood electric vehicles, and 18 electric motorcycles. If these 120 vehicles replaced conventional gasoline powered vehicles and traveled the Vermont average mileage they represent a loss of less than $20,000 in gasoline tax revenue. Loss of gasoline tax revenue from these vehicles is expected to grow with increasing electric and plug-in electric hybrid vehicle adoption. The state's Comprehensive Energy Plan sets a goal of 25% of the vehicle fleet being powered by renewable energy by 2030. Assuming renewable electricity is the source of transportation energy, this would result in 142,975 all electric vehicles on the road in 2030 which would represent a loss of nearly $21 million of gasoline tax at current gasoline prices and average vehicle efficiency.

One concept this report references is the use of existing electric rate setting and fee collection mechanisms to assess transportation energy charges from electric vehicles based on their energy use. This would require some type of metering as well as routing of funds from the local electric utility to the Transportation Fund. Today's electric powered vehicles have a strong correlation between electricity use and vehicle miles traveled and thus electric energy use could serve as a good proxy for transportation system use. In addition, collecting transportation user fees from electric use, combined with Advanced Meter Infrastructure (AMI) would allow for various price signals, including time of use rates, and efficiency charges to be levied. CNG sold for transportation is already taxed via the state sales tax and the state is developing protocols to deposit these revenues into the transportation fund by July 2013.

The timing of policy implementation is an important consideration. Policies must provide adequate revenue while not discouraging early adoption of alternative vehicle technologies that the state ultimately hopes to promote as outlined in the Comprehensive Energy Plan. We propose a number of milestones in the report that may serve as appropriate times to implement fees on alternative fuel vehicle. Implementation of a flat registration fee for electric vehicles could presumably be implemented within one to two years, while a VMT-based system would require multiple years of administrative preparation and policy changes.

Other states are grappling with similar issues and are exploring comparable fee options, including registration fees for CNG vehicles and EVs, and VMT-based systems. There is discussion within the transportation community that it is time to consider alternative funding structures to the current motor fuel tax mechanism, which is increasingly failing to provide adequate revenue to fund and maintain our transportation system. Further, as the range of fuel efficiency within conventional vehicles and the overall operating efficiency of vehicles of all types increases, using fuel or energy use as a proxy for overall system use (i.e., miles driven), as we currently do with gasoline and diesel taxes, is less and less appropriate.

2. Study Scope

The scope of this study was determined by Act 153 Section 39 as described below:

Act 153 (2012 Transportation Program) Section 39: ALTERNATIVE FUEL VEHICLES; USER PAY

Sec. 39 *The secretary of transportation or designee, in consultation with the joint fiscal office and the commissioner of motor vehicles, commissioner of taxes, and commissioner of public service or their designees, shall analyze options for user fees and fee collection mechanisms for motor vehicles that use energy sources not currently taxed so as to contribute to the transportation fund. The secretary shall submit a report of his or her findings, and of options for user fees and fee collection mechanisms, to the joint transportation oversight committee and the joint fiscal committee prior to the joint fiscal committee's November 2012 meeting.*

The bill states that the scope of the study should apply to all motor vehicles using energy sources not currently contributing to the transportation fund. Technically, this applies only to electric vehicles because natural gas sold for transportation is actually taxed under Vermont Statute 23:

- Vermont's statutes 23 VSA Section 3173 states, "For the purpose of this subchapter, gasoline or other motor fuel shall be defined to mean any type of fuel, by whatever name it may be called used in an internal combustion engine to generate power to propel a motor vehicle upon a highways."

And, 32 VSA Section 9741 was amended this past session to state,

- "(7) Sales of motor fuels taxed or exempted under 23 VSA chapter 28 provided, however, that aviation jet fuel and natural gas used to propel a motor vehicle shall be taxed under this chapter with the proceeds to be allocated to the transportation fund in accordance with 19 VSA section 11"

The mechanism to direct funds from the sale of natural gas for transportation to the transportation fund takes effect on July 1, 2013. The bulk of this report is devoted to fee options for electric vehicles, for which there is no system in place, but there is also discussion of natural gas vehicles, for which there is a law but no enforcement at this time.

In its desire to both encourage the use of AFVs while also ensuring that these vehicles contribute to the upkeep of the transportation system, the State faces a dilemma. While instituting new fees on AFVs, particularly EVs, which do not currently contribute to the transportation fund, could be viewed as discouraging further adoption of these vehicles, the significant savings EV owners receive in the price differential between electricity rates and the cost of fossil fuel is still a strong incentive for consumers to purchase EV's. The state's Comprehensive Energy Plan puts forth aggressive goals of reducing fossil fuel use, decreasing overall energy use and increasing the use of renewable energy. Within the transportation sector, achievement of these goals must be balanced with sustainable funding of the transportation network, which has traditionally been funded through user-pay fees consisting of the gasoline tax, the purchase and use tax and Department of Motor Vehicle (DMV) fees. Under the current taxation policy, EVs would only pay the purchase and use and DMV fees of the State's user fee program.

3. Background: Discussion of Electric Vehicle Models and Current Penetration Rates in the Vermont Fleet

3.1 Description of Electric Vehicles on the Market

There are a variety of electric vehicles on the market and the number of available models is expected to grow rapidly in the next few years. Available vehicle types include hybrid vehicles, plug-in vehicles, and all-electric vehicles. In this report we will use the term 'electric vehicle' to refer to any vehicle that plugs in (thus, plug-in hybrids and all-electric vehicles).

Hybrid Vehicles

Hybrids, such as the Toyota Prius, can power the vehicle using the engine, electric motor, or both. These vehicles do not plug-in, thus all power that propels the vehicle ultimately comes from gasoline. The electric motor in these vehicles uses energy stored in batteries and is charged by the engine and through regenerative breaking. These vehicles have the same range as conventional vehicles although generally with much higher fuel efficiency.

Plug-in Hybrid Vehicles

Plug-in Hybrids, such as the Toyota Prius Plug-in and Chevy Volt have both an internal combustion engine and additional energy storage capacity that recharges from the electric grid and allows the vehicle to drive on electricity alone. The all-electric range of the Toyota Prius Plug-in is 11 miles and that of the Volt is 35 miles. Although Vermonters certainly commonly travel farther than the electric ranges of these vehicles, with availability of adequate charging infrastructure a large proportion of Vermonter's vehicle travel could be powered by electricity: approximately 78% of one-way vehicle trips in Vermont are less than 11 miles and approximately 95% of are less than 40 miles.

All Electric Vehicles

All Electric Vehicles include any vehicle driven solely by an electric motor. These vehicles do not use any gasoline. Models currently available in Vermont include the Nissan Leaf and the Mitsubishi i-MiEV. Forthcoming models include the Ford Focus Electric and the Honda Fit EV. The range of the Leaf and i-MiEV is about 80-100 miles, depending on driving style, elevation and temperature.

Projections of electric vehicle penetration

Projecting future rates of fleet penetration of electric vehicles is very difficult given the rapid rate of technological change, uncertainty surrounding available government incentives, volatility of petroleum prices, and the current price differential between electric and conventional vehicles. However, automobile manufacturers have made a commitment to substantial increases in EV production, signaling their belief that this market will prove lucrative and expand quickly.

When Vermont adopts the changes to the California car standards, including the Zero Emission Vehicle (ZEV) mandate, it is estimated that by 2025 15.4% of all vehicles sold will be required to be ZEV. Using the assumption California has considered with Vermont's motor vehicle sales this would result in 850

new electric vehicles placed in service in 2025, or a total of 5,000 electric vehicles placed in service between 2012 and 2025.

There is great speculation surrounding the rate at which EVs will penetrate the state and the nation's fleet. Widespread electrification of Vermont's fleet is one of the primary ways for the transportation sector in Vermont to reach the goals laid out in the state's Comprehensive Energy Plan (25% renewable energy use by 2030 and 90% renewable energy use by 2050). Several Original Equipment Manufacturers (OEMs) have set similarly ambitious targets as shown in Table 1 below.

Table 1. Automobile manufacturer current EV model offerings and 2020 sales goals.

OEM	Current Electric Offerings	Soon to be released	Manufacturer Sales Targets
BMW	ActiveE Fleet	i3, i8	
Coda	Coda Electric (AEV)		N/A (all electric)
Fiat		500 (2013)	
Fisker	Karma (PHEV)		N/A (all electric)
Chrysler	Smart ED	Town & Country minivan (test fleet out now)	
Ford	Focus E (AEV)	Fusion, Energi, C-Max Hybrid,	10-25% of 2020 sales electric
GM	Chevy Volt (PHEV)		10% of 2020 sales electric, hybrid
Mercedes		B class E cell	
Mitsubishi	i-MiEV (AEV)		20% electric and hybrid by 2020
Nissan	Leaf (AEV)		10% of 2020 sales electric
Tesla	Roadster, Model S (AEV)		N/A (all electric)
Toyota	Prius Plug-In		20-30% of 2020 sales electric and hybrid

Electric Vehicle Fuel Cost Comparison

Current electric vehicles tend to be more expensive to purchase than Internal Combustion Engine (ICE) counterparts due to the new technology and relatively low sales. EV batteries are particularly expensive components which are expected to decrease in price as greater economies of scale are made possible with rising sales and enhanced technology.

However, EV operating costs associated with electricity purchases are much lower than gasoline vehicles and can provide substantial savings over the life of the vehicle. For example, a Vermonter with an average vehicle and travel needs will require about 530 gallons of gasoline a year, which amounts to $2,035 in fuel costs annually at $3.85/gallon. The average electric vehicle would require 4,060 kWh of electricity to meet the same travel needs at an annual cost of $490 using an average $0.15kWh rate. This is a savings of $1,545 over a gasoline vehicle. Additional savings may be realized through reduced

maintenance costs since EVs have lower upkeep expenses. The U.S. Department of Energy Alternative Fuel Data Center estimates that the all-electric Nissan Leaf will cost $0.22/mile to operate during the first year of ownership (inclusive of maintenance, energy and insurance) while a conventional Toyota Corolla costs $0.32/mile. Individual savings will vary depending on mileage driven, vehicle efficiency and other factors.

3.2 Current Status of Electric Vehicles in Vermont and Future Scenarios

According to DMV registration records, we estimate that there are currently 120 electric autos (EVs) in use in Vermont. This estimate includes both commercially available models and after-market conversions. There are an additional 62 neighborhood electric vehicles or 'GEMs'. These are vehicles are that are street legal and reach a maximum speed of 30 mph. GEMs are commonly used on college campuses and at golf courses and resorts. In addition there are 18 electric motorcycles registered in the state. The map below suggests that the distribution of EVs is diffuse throughout the state, with vehicles registered in a total of 66 towns. EV's are now registered in nearly a quarter of Vermont municipalities. Between mid-July 2012 and October 3 there was a 40% increase in the number of EVs registered in Vermont. The 120 EVs currently registered in the state represent less than $20,000 annually in lost gasoline tax revenue.

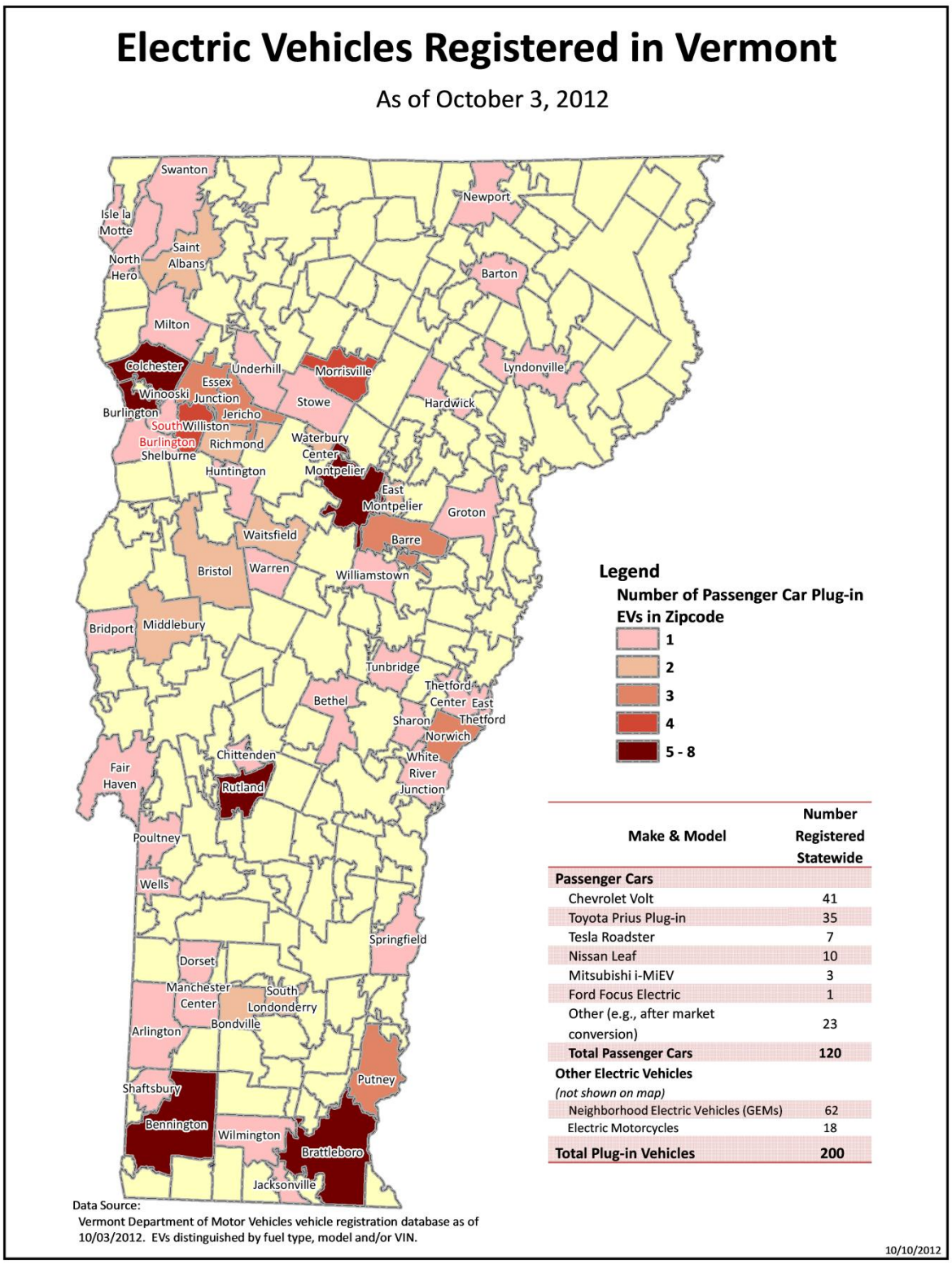

Figure 1. Map of Electric Vehicle Distribution in Vermont by zip code as of October 3, 2012.

A similar analysis of compressed natural gas (CNG) vehicles was not possible due to an inability to reliably identify these vehicles by fuel type in the DMV dataset. A more general assessment of CNG vehicles operating in Vermont is included in section 4.1.3 below.

Comprehensive Energy Plan

Vermont's Comprehensive Energy Plan (CEP) calls for 90% renewable energy use across all sectors by 2050. In addition, an objective of the CEP is to have 25% of vehicles registered in the state powered by renewable sources by 2030. Meeting these goals in the transportation sector through the use of renewable electricity alone would correspond to 142,975 electric vehicles on the road in 2030, representing a nearly $21 million in lost state gasoline tax revenue at current gasoline prices and average vehicle efficiency. By 2050 meeting the CEP goals through renewable electricity would correspond to 514,710 electric vehicles on the road, and more than $75 million in lost gasoline tax revenue.

Achievement of the CEP goals for the transportation sector will most likely require a not yet defined incentive to reduce the upfront cost of EVs for consumers and encourage increased rates of adoption. Further study of potential incentive programs is required to best implement this strategy.

4. Discussion of User Fee Options and Criteria for Assessment

The primary goal of this study is to identify options by which fees may be collected from users of alternative fuel vehicles for contribution to the state transportation fund. In the table below we discuss options identified by the Section 39 Study Group. Only those options that offered some potential of revenue equivalency were included in the final table. In this context revenue equivalency refers to the capability of a fee to replenish the gas tax lost by the replacement in the fleet of a conventional vehicle with an alternative fuel vehicle. The options presented are rated according to three criteria decided by the group:

1. Does the option provide the state a stable revenue stream?
2. Is the option practical to implement and administer, and easy for users to understand and accept?
3. Is the option consistent with state energy and economic goals? The state energy goals that we used as assessment criteria are those laid out in the state Comprehensive Energy Plan (CEP).

Broadly, the CEP goals for the transportation sector aim to encourage use of alternative fuel vehicles and renewable sources of energy and reduce vehicle miles traveled in the state. Specific CEP Goals relevant to this study include:

a. Reduce petroleum consumption and accelerate the switch to renewable fuels:
    i. Ensure that 25% of all vehicles registered in Vermont are powered by renewable sources by 2030
b. Reduce energy use in the transportation sector
    i. Keep VMT annual growth rate to 1.5% or less for that portion controlled by the state
    ii. Keep VMT per capita level with the 2011 base year, or lower
c. Address transportation funding (all options considered in the table below fulfill this goal, to some extent)
    i. Establish revenue sources to support Vermont's entire transportation system in a state of good repair

Economic criteria considered in assessing these options include:

a. Fairly allocates the cost of maintaining the transportation system among users
b. Would not place Vermont businesses at a competitive disadvantage compared to other states

Table 4 on the following pages summarizes fee options considered by the Section 39 Study Group. Detailed descriptions of the options are included subsequent to the table.

Table 4. Potential User Fee Options and Criteria Identified by the Section 39 Study Group

	Criteria			
Options by Fuel Type	**Stable Revenue Generation**	**Practical and Acceptable to Implement and Easy to Understand**	**Consistent with State Economic and Energy Policy**	**Rate required to achieve revenue neutrality[1]**
Registration fee for Electric Vehicles	*Yes: makes up for lost gas tax revenue*	*Yes: easy for users to understand and the state to implement*	*Neither discourages nor encourages AFV use*	To replace lost gas tax revenue: $146/annually per vehicle
AFV License Plate	*Yes: provides additional source of revenue*	*Yes: easy for users to understand and the state to implement*	*Neither discourages nor encourages AFV use*	As a one-time fee, this would provide additional revenue, not achieve revenue neutrality. If charged annually at $146/vehicle, it would achieve neutrality, similar to the registration fee above.
Vehicle Miles Traveled fee	*Yes*	*If done on a simple per mile basis, compliance with the fee structure will be easy for users.*	*Yes:* • *Fairly allocates the cost of maintaining transportation infrastructure* • *Encourages VMT reduction* • *Encourages reduced energy use in the transportation sector*	$0.013/mile flat rate would achieve revenue neutrality; Other states have proposed fees ranging from $0.17-$0.24/mile which include additional time of use and congestion fees

[1] All rates assume revenue neutrality: on a per vehicle basis, the revenue provided by this fuel type is equivalent to the average amount of gas tax raised. See appendix for all relevant calculations.

	Criteria			
Options by Fuel Type	**Stable Revenue Generation**	**Practical and Acceptable to Implement and Easy to Understand**	**Consistent with State Economic and Energy Policy**	**Rate required to achieve revenue neutrality[1]**
Volumetric taxes				
Gasoline and Diesel, current rates	*No: declining*	*Yes*	*Yes:* • *Fairly allocates the cost of maintaining the transportation system to gasoline powered vehicle drivers on the system.* • *Encourages reduced petroleum use*	Gasoline: $0.20 + 2% average quarterly retail price/gallon = $0.265 / gallon at current rate Diesel: $0.29 /gallon
Natural Gas (VT sales tax)	*Yes*	*Yes:* *This fee mechanism is both easy to understand and implement. By law, the revenue generated from this sales tax should be routed to the transportation fund.*	*Neither encourages nor discourages AFV use. Appropriate routing of revenue generated to the transportation fund will support the CEP goal to adequately fund the state's transportation system*	Neutrality would require:18% at current prices, or implementation of a new transportation tax, in addition to the current sales tax of 6% or an excise tax of $0.277/100 ccf
Fee on electricity used for transportation	*Yes*	*Yes:* *Although implementation of a fee system based on kWh usage may require additional metering.*	*Yes:* • *Encourages VMT reduction by being directly tied to use*	$0.036/kWh
Alternative Fuels Matrix Conversion (tax these fuels at the same rate as gasoline, based on gasoline gallon equivalents)	*Yes and No:* *This option only achieves adequate revenue for natural gas, not electricity, due to the higher efficiency of EVs.*	*Yes:* *Taxes collected from sales of CNG would need to be routed to the transportation fund.*	*Yes: encourages use of AFVs through reduced tax rate on EVs*	Natural gas: $0.218/ccf Electricity: $0.008/kWh

4.1 Description of Options[2]

4.1.1 Electric Vehicle Registration Fee

At the rates currently charged in other states ($25-100 annually), an additional electric vehicle registration fee would probably not adequately replace current fuel tax revenue which is approximately $146 per vehicle annually. A registration fee would be administratively easy and inexpensive to administer but could be viewed as less equitable than other options, because it is not linked in any way to use (vehicle miles traveled) or vehicle efficiency. This fee may be an ideal short-term means of ensuring that electric vehicles (and possibly other AFVs) contribute to the state transportation fund while not overly discouraging adoption of these vehicles.

We suggest that the most equitable and revenue neutral way to calculate an appropriate fee level would be to determine the mean amount of gas tax paid annually by the average Vermont driver using average rates of annual vehicle miles traveled, fuel economy, gas prices and gas taxes in the state: $146.

Thus, an annual fee of $146 levied on EV users at the time of annual registration would replace lost revenue while also ensuring that these users contribute approximately the same amount to system maintenance as the average driver in the state.

Some states already charge a flat registration fee for AVFs, instead of a fuel sales or excise tax. Generally these are for natural gas vehicles rather than electric vehicles, and include Oklahoma ($50-150 annually, depending on vehicle weight) and Colorado ($70 annually). Illinois offers EVs a discounted registration fee of $18 annually. Washington State requires EV owners to pay an additional $100 annually to make up for lost gasoline tax revenue. Electric ehicles registered out of state would not contribute to the Vermont transportation fund in this case, despite their use of the system.

4.1.2 Electric Vehicle License Plate

Requiring electric vehicles to purchase a specific license plate for a fee provides a one-time source of revenue from these vehicles. On its own, this fee would not replace lost gas tax annually, but could provide additional revenue, in addition to alerting emergency personnel that the vehicle is an EV in the event of a vehicle crash. The emergency protocol and fire hazards associated with a crash involving an EV differ from those of a conventional vehicle and presently vehicle type may not be obvious to emergency responders. The major difference is the presence of high voltage electrical systems contained in electric and hybrid vehicles. The National Fire Protection Association has a number of trainings available for first responders to broaden and deepen an understanding of the differences between vehicle types especially when it concerns flammable liquids and high-voltage concerns at an incident scene.

4.1 .3 Volumetric taxes

Compressed Natural Gas

At present, natural gas sales for transportation are taxed at the Vermont sales tax rate of 6% and providers are obliged to contribute this amount to the transportation fund. There are currently three

[2] See Appendix for all relevant calculations.

compressed natural gas (CNG) filling stations in Vermont, maintained by Burlington Department of Public Works, Vermont Gas Systems, and Casella Waste Management. These stations are used primarily by fleets such as the University of Vermont and Vermont Gas. In 2010, a total of 3.75 million cubic feet of CNG was sold at these stations, the equivalent of over 20,520 gallons of gasoline or 19,500 gallons of diesel. Although not all CNG sold at these stations is taxable, at a rate of 6%, the cubic feet sold in 2010 would have generated $1,731 at a pre-tax price of $1.11/100 ccf[3]. Taxed on a gge basis at the current tax rate, sales of this CNG, if routed to the state transportation fund, would have generated $5,684.

The relative fuel density and efficiency of CNG and conventional vehicles are comparable, thus, replacing the lost gas tax on a gge (MMBtu) basis in the case of natural gas vehicles will accomplish approximate revenue neutrality. However, the current 6% sales tax is lower than gasoline tax (~7.75% at current retail prices).

Further, due to the lower cost of CNG relative to gasoline, a higher tax rate would be required to achieve revenue neutrality: 18% at current prices. It may be administratively easier to implement a new 12% transportation tax on CNG to achieve revenue neutrality, rather than increasing the current sales tax. If an excise tax were to be assessed for CNG, a rate of $0.277/100 ccf would be required for revenue neutrality, the same amount as that levied on a gallon of gasoline.

Electricity

There is no transportation fee currently levied on electric vehicles. Taxing these vehicles at a rate based on the energy equivalent of gasoline (gasoline gallon equivalent or gge) would not provide adequate revenue due to the higher operating efficiency of electric vehicles. However, a revenue neutral amount could be determined assuming EV vehicles will exhibit travel patterns similar to conventional vehicles and be driven approximately 12,700 miles annually (annual VMT per vehicle in Vermont, based on FHWA estimates of statewide VMT and DMV records of total number of registered vehicles in the state)[4]. An important consideration when setting equitable rates for EV users is that these vehicles may not be driven in the same way that conventional vehicles are. Due to range limitations these vehicles may be driven less. Rapid advances in EV technology could significantly increase the range of vehicles and increase the potential for VMT due to lower vehicle operating costs.

We estimate that a rate of $0.036/kWh would provide $146 to the transportation fund annually, per vehicle, approximately the same amount derived from conventional vehicles via the gasoline tax.

To our knowledge, Pennsylvania is the only state that has implemented a tax specifically on the electricity to power vehicles (at a rate of $0.0093/kWh). These compare to an average Vermont residential electric rate of $0.15/kWh

[3] EIA estimate of average commercial price of natural gas in Vermont in 2010 (EIA reports the post-tax price of 1.18/100 ccf)

[4] However, based on 2009 survey data from the Federal Highway Administration (http://nhts.ornl.gov), we estimate that the average vehicle in Vermont drives closer to 11,575 miles annually and that approximately 10% of the annual VMT driven in Vermont is driven by out of state vehicles.

Sub-metering or technological developments may be required to differentiate energy used for transportation from that used for other residential and commercial purposes. Such metering may be facilitated with widespread deployment of Smart Grid technology in the state. The revenue generated from the proposed EV user fee would need to be routed from the local electric utility to the transportation fund. At present all electric rates in Vermont, include an electricity efficiency charge or EEC. The EEC rates vary as follows for customers without Demand Charges:

- Residential: $0.00931/kWh
- Commercial: $0.00796/kWh
- Industrial: $0.00541/kWh

This charge is used to fund efficiency programs that ultimately reduce overall demand and rates for all ratepayers, statewide. This charge is routed from local utilities to regulators, to a statewide energy efficiency utility (EEU), Efficiency Vermont, which administers efficiency programs in support of the state's statutory framework to provide electricity service on a least-cost basis. Current electric vehicle owners are paying this rate. Assuming 10,000 miles driven annually (less than a gasoline powered vehicle) and an efficiency of 0.32 kWh/mile, each electric vehicle charging at home is generating almost $30 annually in EEC. The current 120 electric vehicles are thus generating nearly $4,000 in EEC funds. 142,975 vehicles (the 2030 CEP goal) would generate nearly $4.3 million in EEC funds.

Electric vehicles provide the opportunity for creation of a similar efficiency charge to be devoted to transportation efficiency projects (demand management programs). In the case of electric vehicles, funds raised from fees on electricity used for transportation would be routed through the local utility, to regulators, and then to the state agency of transportation, where the bulk of collected fees would be dedicated to system maintenance (replacing funds raised via the gas tax), and a portion would be dedicated to transportation demand management (TDM) programs to increase overall system efficiency. This would be quite similar to the current system of collecting gasoline taxes and using a portion of total transportation fund revenue for TDM programs like Go Vermont! and transit and other non-highway infrastructure.

What would be different is the ability to implement Time of Use rates and other price signals that could be used to fund TDM programs and infrastructure. Time of Use (TOU) rates refers the time that the electricity is drawn down from the grid. TOU rates are an understood and accepted utility practice. One means of administering such programs would be through establishment of a transportation efficiency utility, either housed within the Agency of Transportation, or as a separate entity, similar to Efficiency Vermont. These efficiency programs would incentivize non-SOV modes of travel, much the same that an EEU incentivizes upgrades of buildings to reduce electricity demand. Further, transportation efficiency and TDM measures could include capital investments in transit and bicycle and pedestrian facilities to further encourage and adequately fund other modes of transport. **Figure 4** provides a diagram of the flow of funds from EV users to VTrans and a state transportation efficiency program.

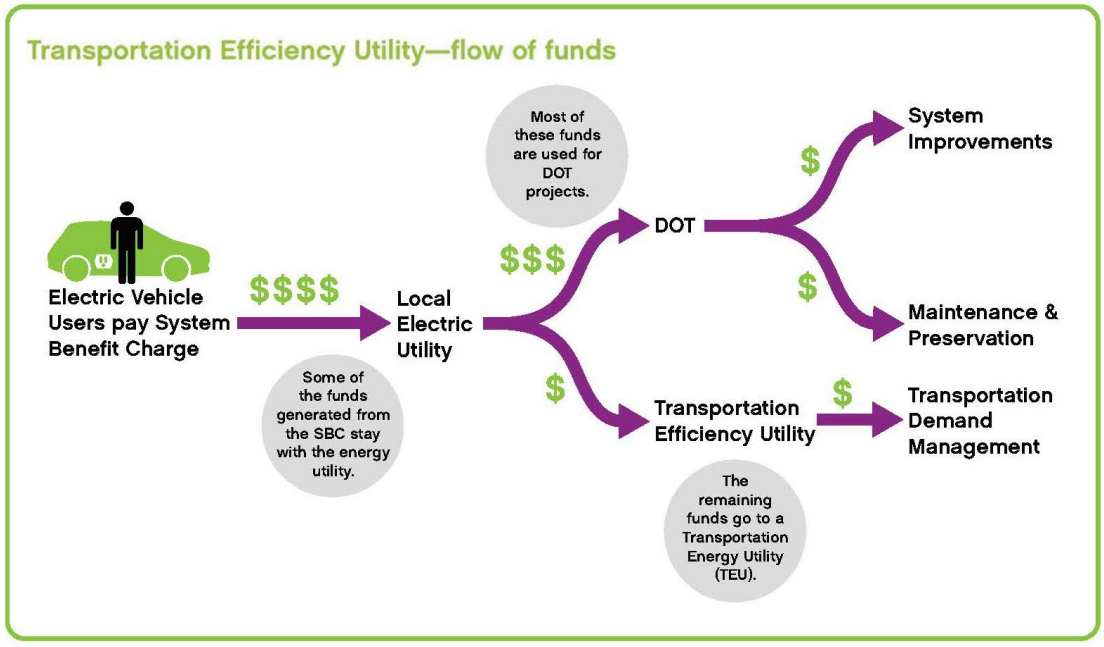

Figure 4. Transportation Efficiency Utility Process. Arrows indicate potential flow of funds.

Along somewhat similar lines, a number of cities around the country have recently implemented transportation utility fees: fees that are assessed on a per building basis, rather than per vehicle (discussed in further detail in Section 5.2). These fees are not specific to alternative fuel vehicles, but treat the transportation system more as a public good, of which we are all users. There are many analogies between the transportation system and regulated public utilities.

Alternative Fuels Matrix Conversion

By converting the energy density of power sources to gasoline gallon equivalents (gge), a common form to determine the equivalent tax rates among these energy sources, can be used. For instance, 1 gallon of gasoline contains 114,000 Btu's and is taxed at approximately $0.277/gallon. One gallon of gasoline is equivalent to 33.41 kWh, which under this system could be taxed at a rate of $0.008/kWh. One gallon of gasoline is also equivalent to 1.14 ccf CNG, which would be taxed at $0.238/ccf. Federal transportation tax rates on CNG are set using this methodology, equating to $0.043/gge, and generate funds that by law should be routed to the federal highway trust fund.

Depending on vehicle efficiencies, this system may have implications for revenue neutrality and result in operators of alternative fuel vehicles contributing considerably less to transportation funds than equivalent conventional vehicles. This system is equitable if using a metric of energy content (essentially $/Btu) but not necessarily when using a metric of system use (miles driven). Electric vehicles have a considerably greater operating efficiency on a per-BTU-basis, thus these vehicles would pay approximately 3 times less into the transportation fund than the average conventional vehicle because an electric motor is three times more efficient than an internal combustion engine. This 'discount' should be factored in when considering revenue implications of such a system and could also be considered an incentive to encourage further EV adoption.

On a BTU basis, the efficiency of NGVs is similar to that of conventional gasoline vehicles. One of the criteria to consider when assessing user fee options is whether the fee covers the cost of the system. While CNG and electric vehicles may contribute less than conventional vehicles if a gge fee structure is adopted, these vehicles also emit fewer tailpipe emissions, effectively reducing the air quality costs associated with motor vehicle use.

4.1.3 Vehicle Miles Traveled (VMT)-based fee

A user fee based on vehicle miles traveled presents perhaps the most equitable option, by many criteria, as well as providing the greatest opportunity for optimized demand management. This option is a long term solution that would require significant policy changes before implementation. A number of states have studied and are considering this option (described in Section 5.2). A VMT-based fee would provide users clear incentive to drive less (although not necessarily a more fuel efficient vehicle). Further, use of on-board GPS units could track where and when vehicles are in use, and apply mileage fees accordingly- effectively charging people more to drive at peak hours in congested areas.

We estimate that a VMT fee of $0.013 per mile would achieve revenue neutrality, based on average vehicle miles traveled in the state and average fuel efficiency.

A change to a VMT-based fee system would be a massive shift in how our transportation system is funded merits consideration of a number of issues. For instance, a fee system based only on miles traveled provides little incentive for use of fuel efficient vehicles. A sliding scale of registration fees could counteract this, based on vehicle fuel or operating efficiency. In addition, in the absence of a national or regional VMT-based system, vehicles registered out of state would not contribute to the Vermont transportation fund, despite their use of the system.

Most simply, a VMT tax could be administered using odometer readings, a system that would offer fewer price levers to encourage demand management techniques but may present fewer privacy concerns and greater ease of administration. Currently annual odometer readings are collected as part of the annual vehicle air quality inspections. However, this data has not to date been entered into any database or analyzed. In the case of AFV's, if these vehicles are driven less than conventional vehicles (for instance due to limited range in the case of EVs), then the proposed VMT-fee may not achieve revenue neutrality.

A more sophisticated system presents clear pros and cons: there are privacy concerns around use of GPS units and implementation and maintenance of such a system would be administratively costly. Further, an overly complicated pricing structure may confuse users and affect travel behavior less than anticipated. However, this is one the few options explored here that offers clear mechanisms for optimized demand management and was a highly recommended option by the National Surface Transportation Infrastructure Financing Commission in the 2009 report 'Paying Our Way.' This option is generally thought to have little public support (although participants in an Oregon pilot study were supportive upon completion of the study) and has not been endorsed by the Obama administration or

Congress. A more sophisticated VMT fee system (one utilizing time of day and location-based rates) could be developed with the goal of revenue equivalency using estimates of vehicle travel derived from the statewide model.

In the case of EVs, a VMT-based fee system may be easier to implement because many of these vehicles are already equipped with electronic/wireless communication onboard devices that record miles traveled and energy used and are able to communicate with external devices (e.g., smart phones). Thus, data collection from these vehicles could be administratively simpler than conventional vehicles.

4.2 Timing of policies

The timing of policy implementation is an important consideration. Policies must provide adequate revenue while not discouraging early adoption of alternative vehicle technologies that the state ultimately hopes to promote as outlined in the Comprehensive Energy Plan.
Proposed milestones that may serve as appropriate times to phase in fees on alternative fuel vehicles include:

- When EVs comprise a given percentage of new and used vehicle purchases
- When smart grid is available statewide and we can reliably track energy use of EVs and the amount of electricity powering transportation
- When transportation accounts for a given percentage of electricity demand
- When the 2030 Comprehensive Energy Plan goals of 25% of fleet is EVs are met
- When gasoline tax revenues fall by a given percentage or amount

Another suggestion that came up during discussion with the Section 39 Study Group was the blending of fee options, depending on the fuel type. For instance, implementing either a VMT or volumetric tax on current EV users. If the hope is to ultimately switch to a VMT-based fee system, it may be logistically easiest to to begin this system first with a small group of EV users. It is possible that a VMT-based system linked with the current efficiency charge for electricity to promote efficient transportation (TDM programs and infrastructure) could advance multiple state policy goals including revenue neutrality with the current gasoline tax as well as providing earmarked funds for transportation efficiency. In addition, a blended fee option could result in no one system bearing the full cost of the system, potentially improving acceptance of new fee systems.

Alternatively, the group suggested instituting a flat fee upon registration for EV users, and then offering users the option of opting out of the fee for the first year that they own their vehicle if they agreed to be a part of a study. This study would allow travel data on EV use and charging patterns to be gathered. At present we do not know if these vehicles exhibit different travel patterns than conventional vehicles, nor how their widespread use may impact electricity demand. Real-world data would be valuable in this respect and allow for more nuanced planning and preparation for these vehicles.

A flat EV registration fee could be implemented easily within the next year or so. The fee suggested ($146) is presumably not large enough to actively discourage potential EV adopters when included as

part of the total operating cost since EV owners save thousands of dollars annually by not purchasing gasoline and from greatly reduced maintenance costs.

5. Other Background Information and Considerations

5.1 Transportation System Users and Least Cost Options

As we move away from conventional vehicles for our travel and struggle to maintain stable and adequate revenue for our transportation system, it may be an appropriate time to reconsider our transportation funding architecture. Brooks et al. (2012) note the difficulty in differentiating CNG and electricity used for transportation from that used for residential (and commercial) purposes. Although this may change with Smart Grid technology and separate meters for EV charging, it raises the questions of 1) how and if utilities should tax these energy sources differently for transportation such that users can contribute to transportation funds? And 2) is it time to change how we raise revenue for transportation?

In addition to this report the legislature in Section 40 of Act 153 required a study of; estimated transportation and TIB fund revenues over the next five years, estimate the gap between costs and projected revenues over the next five years and evaluate potential new state revenue sources, including a vehicle miles traveled tax.

At present, a 'user' (and thus primary funder) of the transportation system generally refers to drivers and riders of public transit. Pedestrians and bicyclists are also users whose needs are considered, although these users do not have any direct means of contributing to the system. Although we have historically funded our transportation system primarily through a user pay system, we have also collectively acknowledged the necessity of a functioning system and the importance of mobility, that is, the ability to get where one needs to go to access services and be an active member of one's community, regardless of disabilities, age, income, and vehicle ownership. Given current declines in licensing rates among teenagers, we should be especially conscious of providing access to non-drivers.

In considering new and equitable ways to sustainably fund our transportation system, it may be time to reconsider what a user of the system is, and whether we should continue with the current definition of a user-pay system. Because a wider swath of society than drivers benefits from a functioning transportation system, some have suggested that it is time to view a functioning transportation system as public good, much the same way we do a functioning electric grid, education system, etc. (e.g. Rahn 2012). Funds to maintain these societal benefits often come from the general fund because they are assumed to benefit all members of society, not just users. A similar case could be made for transportation because we all rely on the roads to allow reliable transport of our food, mail, goods, and emergency vehicles, regardless of whether we ourselves drive.

An alternative approach to transportation planning and funding is least cost transportation planning (LCTP), an approach discussed at length in Vermont's 1998 Comprehensive Energy Plan. Under an LCTP approach, the public's transportation needs are met by means that pose the lowest overall cost to

society. LCTP is inspired by Least Cost Integrated Planning, the approach that energy utilities use to meet energy needs via the lowest present value *full life cycle cost*. Under an LCTP approach to transportation planning and funding, we are all users of the system and an accounting for true costs of projects and the system as a whole is crucial to facilitating optimized decision-making and resource allocation.

As the range of fuel efficiency within conventional vehicles and the overall operating efficiency of vehicles of all types increases, using fuel or energy use as a proxy for overall system use (i.e., miles driven) is less and less viable. From **Table 6** we see that five popular models driving the same number of miles differ by as much as 100% in the amount that they contribute annually to the transportation fund: from $70 for the Toyota Prius to $195 for the Ford F-150 pick-up. The wide range in vehicle fuel efficiencies now available highlights the breakdown of fuel use as a proxy for miles driven or system use. At present there is less variability in the efficiency of available electric vehicles (especially among all electric vehicles, rather than plug-in hybrid electric vehicles) and as a result, a considerably smaller range of estimated contribution to the transportation fund, assuming a per kWh charge was implemented (**Table 7**).

Table 6. Estimates of fuel efficiency and annual amount paid in gas tax by different vehicle types (assumes statewide average of annual VMT, 12,700 miles)

Vehicle Model	Miles per gallon	Annual Amt. Paid in Gas Tax ($)	Miles/MMBtu
Honda Fit (compact)	30	$117	263
Toyota Camry (sedan)	25	$141	219
Ford Explorer (SUV)	20	$176	175
Ford F-150 (pick-up)	18	$195	158
Toyota Prius (hybrid)	50	$70	439

Table 7. Estimated operating efficiency and annual amount paid into the state transportation fund by electric and plug-in hybrid electric vehicle available in Vermont (assumes statewide average of annual VMT, 12,700 miles[5]). Gas tax revenue for plug-in hybrid vehicles includes that generated from gasoline and electricity purchases. Electricity transportation fee is $0.036/kWh, a rate which should achieve approximate revenue equivalency with the average conventional vehicle.

Vehicle Model	Miles/kWh (and miles per gallon for plug-in hybrids)	Annual Amt. Paid into Transportation Fund (proposed)	Miles/MMBtu
Mitsubishi i-MiEV	3.3	$138	1,050
Nissan Leaf	2.9	$158	922
Chevy Volt (70% of miles powered by electricity)[6]	2.8 miles /kWh, 37 mpg	$125	720
Toyota Prius Plug-in (20% of miles powered by electricity)[5]	3.4 miles/kWh, 50 mpg	$83	952

5.2 Activities in Other States

The Energy Information Administration predicts that by 2035, 49% of new vehicle sales in the U.S. will be of alternative fuel vehicles. According to the National Conference of State Legislators (2012), currently, 27 states have some form of tax on alternative fuels (ethanol, CNG, biodiesel, electricity) and 23 of these dedicate some of this tax to transportation projects. Nine states impose a flat, annual fee on alternative fuel vehicles, and five states allow people the choice of a fuel tax or annual fee. New Hampshire is currently conducting a study of funding options for alternative fuel vehicles (focused on CNG and electric vehicles), similar to this study. Although still underway, an annual registration fee, based on an estimate of average lost tax revenue per vehicle, was an option garnering support from the NH study group, due to administrative ease.

A number of states are considering VMT-based fees to fund transportation projects, but only Illinois has implemented such a system to date, and only for trucks. Arizona, Massachusetts, Mississippi, and Oregon are all considering bills to establish a VMT-based fee for EVs and 18 states have undertaken some type of pilot project (many under a DOT-funded project). A total of eight states (California, Colorado, Hawaii, Indiana, Massachusetts, Texas, Virginia, and Washington) have either begun or authorized a VMT-based pilot program or study. Only Oregon has conducted such a study, to date. The University of Iowa Public Policy Center has been conducting a four year study of mileage-based road user charges nationwide and has collected data from vehicles in at least 12 states thus far.

As of September 2011, Pennsylvania was the only state with a tax specifically on electricity to power vehicles ($0.0093/kWh; based on gge), although enforcement may be difficult as there is no

[5] However, based on 2009 survey data from the Federal Highway Administration (http://nhts.ornl.gov), we estimate that the average vehicle in Vermont drives closer to 11,575 miles annually and that approximately 10% of the annual VMT driven in Vermont is driven by out of state vehicles.

[6] Based on Vermonter daily travel derived from the 2009 National Household Travel Survey for Vermont (see UVM TRC Fact Sheet 'Can Electric Vehicles Meet Vermont's Travel Demand?' http://www.uvm.edu/~transctr/pdf/factsheet7.pdf)

requirement for separate metering of EV electric use. Compliance with the law requires EV owners to self-report their vehicle charging electricity usage. Separate metering of electricity used for transportation is occurring, however. The utility Alabama Power offers a Plug-in Electric Vehicle (PEV) Charging Rate Incentive that provides businesses an electric vehicle Time-of-Use rate for electricity purchased to charge EVs used for non-residential purposes. The electricity used for vehicle charging is metered separately from all other electricity use.

Many utilities around the country have implemented time of use (TOU) charging, irrespective of whether the power is used for transportation or other purposes. Data on EV charging patterns collected by the Idaho National Lab (2012) suggests that EV users respond to these rate differentials, charging randomly in the absence of a TOU rate structure, while in those areas with TOU charging, the bulk of charging occurred off peak. As of June 2012, 22 electric utilities in 11 states had enacted specific rates or tariffs for charging of electric vehicles, all of which have different rates for peak and off-peak hours (Northeast Group 2012). However, no portion of these tariffs is currently routed to transportation project funding.

Other alternative fuel fee systems in use on other states are listed in **Table 8** (as described on the DOE Alternative Fuels Data Center website and the report “Sharing the Road, Sharing the Cost”, 2012).

Table 8. Alternative Fuel Fee Systems Currently in Use, by State

State	Fee
Alabama	Liquefied petroleum (LPG) and CNG vehicles are subject to an annual fee based on weight and out of state CNG vehicles must pay the current state fuel tax.
Arkansas	Alternative fuel vehicles are subject to an excise tax, determined on a gasoline gallon equivalent basis. The tax rate for each fuel type is based on the number of motor vehicles licensed in the state that use the specific fuel, not including vehicles the federal government owns or leases
Nebraska	Alternative fuel vehicle operators must purchase a user permit; CNG and LPG fuel sold for transportation are subject to an excise tax of %0.075/gallon
New Mexico	Alternative fuels are subject to a $0.12 per gallon equivalent or operators may pay an annual fee based on vehicle weight (these fees range from $60 to $1,100).
Pennsylvania	Alternative fuels and energy are taxed on a GGE basis. This amounts to a charge of $0.0093/kWh on electricity used to power electric vehicles.
South Carolina	Alternative fuels are exempt for state sales and use tax but subject to a state fuels tax
Washington	CNG and LPG vehicle owners pay an annual fee based on vehicle weight in lieu of a fuel tax (these fees range from $45-250).
Vermont	Vermont's statutes 23 VSA Section 3173 states "For the purpose of this subchapter, gasoline or other motor fuel shall be defined to mean any type of fuel, by whatever name it may be called used in an internal combustion engine to generate power to propel a motor vehicle upon a highways." 32 VSA Section 9741 was amended this past session to state, "(7) Sales of motor fuels taxed or exempted under 23 VSA chapter 28 provided, however, that aviation jet fuel and natural gas used to propel a motor vehicle shall be taxed under this chapter with the proceeds to be allocated to the transportation fund in accordance with 19 VSA section 11"

In addition, the Transportation Utility Fee system used in Oregon and Austin, TX, is not specific to AFVs but may be of particular interest as the transportation sector becomes electrified. These fees are administered by building, similar to other utility charges (water, electricity, natural gas) and are fuel or energy 'neutral', affecting all vehicle types the same because the fee is assigned to the building. Generally, a transportation utility fee estimates the number of trips generated by a particular building type (commercial, residential, square footage, number of employees/household members, etc.) in a given location, and calculates a level of system use. TUFs are currently used in at least 26 cities in 7

states (most commonly in Oregon). Some of these cities offer utility fee discounts to the elderly, low income residents and those with no vehicle.

5.3 Activities in Other Countries

We did not find literature to suggest that other countries (e.g., those in Europe, Australia) have taken (or proposed) action to prepare for potential losses in fuel taxes as use of alternative fuels increases. We also reviewed more general transportation finance at the national level in a number of EU states and Australia. In contrast to the U.S., transportation in most of these nations is less tightly tied to a user-pay system. Some revenue generated through high fuel taxes is re-routed to the general fund (as was the case in the U.S. in previous years when some of the federal gasoline and diesel tax revenue went toward deficit reduction) and in many cases funding for transportation projects (rail, road, transit), comes out of the general fund. Both Australia and Germany are either transitioning or considering a transition to a user-pay system. EU member Estonia, which has made a strong commitment to fleet electrification, funds most transportation projects through the general fund, not transportation user fees or fuel taxes.

Higher fuel and other transportation taxes fund not just transportation but programs in other sectors such as healthcare and education. On average, in Europe, transportation taxes total 142% of the total spent on roads. Similarly, Canadian gas taxes totaled $11.7 billion in government revenue in 2008, while the country's total transportation expenditures in that year were only $4.1 billion (AASHTO 2011).

In France, the effects on government revenue streams of a switch away from conventional vehicles to EVs is unclear but potentially less substantial than in the United States. Leurent and Windisch 2012 estimate that the revenue collected from an EV over the course of the vehicles lifetime will be 16% less than that collected from a conventional vehicle, accounting for the current tax credit of 5,000 Euros. In the absence of this credit, revenue collected from these vehicle types is approximately equivalent. Although fuel taxes are higher than those on electricity, both vehicles are subject to a value added tax (which generates sizable revenue in the case of currently more expensive EVs), as well as a variety of other taxes. However, Van Dender & Crist (2010) note that while overall tax revenue generated by EVs and conventional vehicles may not differ widely, the fuel tax is administratively much easier and cheaper to collect than other taxes, thus replacement taxes may be more expensive to collect. Several European countries also charge annual registration or vehicle sales fees based on greenhouse gas emissions.

6. Conclusion

The long-term viability of Vermont's transportation infrastructure will require ongoing support from user fees collected from system users and beneficiaries. As the energy powering our transportation system diversifies, new funding mechanisms will be required. Here we present a number of funding options for the consideration of lawmakers and transportation planning officials such that revenue neutrality or equivalency with the current system can be achieved. These options must be considered within the context of multiple, sometimes contradictory or competing goals of state government. Vermont has goals to substantially reduce fossil fuel use and encourage transition to alternative fuel vehicles, while also recognizing the need to fully and safely fund the transportation system in an equitable and sustainable way. Because primary funding for the transportation system is derived from the gasoline and diesel taxes and depends upon continued use of fossil fuel use at current rates, these goals and funding mechanisms require re-examination. The options discussed in this report will be submitted to the Vermont Joint Fiscal Committee in November 2012 for their consideration.

7. Literature Cited

AASHTO. 2011. The Forum on Funding and Financing Solutions for Surface Transportation In the Coming Decade.

Brooks et al. 2012. Highway Spending and Taxing Alternative-fuel Vehicles. Downstreamtoday.com.

DOE Alternative Fuels Data Center (http://www.afdc.energy.gov/)

Idaho National Lab. 2012. Clean Cities Webinar – The EV Project & Other Electric Drive Vehicle Testing Results to Date (June 2012). Idaho National Laboratory, http://avt.inl.gov/pdf/PEVs_n_EVProjectCCWebinarJune2012.pdf.

Leurent & Windisch. 2012. Avantages et coûts du véhicule élictrique pour les finances publiques: modèle d'évaluation inégrée et application au territoire français. Congrès ATEC 2012.

National Conference of State Legislatures. 2012. On the Move: State Strategies for 21st Century Transportation Solutions.

National Surface Transportation Infrastructure Financing Commission Sharing the Road, 2009. Sharing the Cost.

Northeast Group, LLC. 2012. U.S. Smart Grid: Utility Electric Vehicle Tariffs, Volume II.
Transportation and Climate Initiative. 2012. Plug-in Electric Vehicle Deployment in the Northeast: A literature Review.

Rahn, P. 2012. Simple Key to Funding Crisis. Philadelphia Inquirer editorial, September 9, 2012.

Van Dender & Crist. 2010. What does improved fuel economy cost consumers and taxpayers? Some illustrations. 2010 ITF-KOTI Joint Seminar on Green Growth in Transport. Paris: OECD Publishing.

Appendix

Fee Calculations to Achieve Revenue Neutrality

Electric Vehicle flat registration fee

At an average annual VMT of 12,700 per vehicle, an average vehicle fuel efficiency of 24 miles/gallon, the current gasoline tax ($0.20/gallon + 2% retail price), and a cost of $3.85/gallon, the average driver contributes ~$146 to the transportation fund via the gas tax.

(12,700[7] average annual vehicles miles traveled per vehicle) / (mean vehicle fuel efficiency of 24 mpg) = 529 gallons purchased annually

(529 gallons) x ($0.20 tax/gallon) + (2% tax on retail sale price/gallon x $3.85/gallon) =

$146 *estimated lost gas tax per vehicle*

Compressed Natural Gas Sales Tax (or additional Transportation Tax) and Excise Tax

Gasoline is currently taxed at a rate of 7.75%/gallon (although this tax is volumetric and not entirely linked to inflation, so it varies with the price of gasoline), higher than the 6% sales tax levied on natural gas. Further, due to the lower price of natural gas ($3.85/gallon for gasoline vs. $1.64/100 ccf for natural gas) a higher sales tax would be required to achieve revenue neutrality. To generate $0.277 / 100 ccf (roughly the equivalent of 1 gallon of gasoline), at current pre-sales tax CNG prices, the total tax rate would need to be 18%:

$0.277/ $1.54 /100 ccf= 18.0%

As mentioned in the report, this additional 12% tax could be levied in the form of an additional 'transportation tax', rather than by increasing the sales tax. Regardless, a tax rate of 18% would be required at current CNG prices.

One gallon of gasoline contains 0.114 MMBtu and 100 ccf CNG contains 0.100 MMBtu. On a MMBtu or energy content basis, the price of these two fuel types is $33.77/MMBtu for gasoline and $20.51 for compressed natural gas.

To achieve revenue neutrality through an excise tax on CNG, an equivalent tax rate to the current gasoline tax rate should be used:

$0.277/100 ccf

[7] However, based on 2009 survey data from the Federal Highway Administration (http://nhts.ornl.gov), we estimate that the average vehicle in Vermont drives closer to 11,575 miles annually and that approximately 10% of the annual VMT driven in Vermont is driven by out of state vehicles.

Electric Vehicle

A user fee of $0.036/kWh would generate approximately the same amount of revenue per vehicle as the current gas tax ($0.277/gallon, $146/vehicle annually), assuming an annual VMT of 12,700 miles, and electric vehicle efficiency of 0.32 kWh/mile and a conventional vehicle efficiency of 24 miles per gallon.

(0.32 kWh/mile) * (12,700 miles /year) = 4,064 kWh /year

($146 / year) /(4064 kWh/year) = $0.036/kWh

Alternative Fuels Matrix

In an alternative fuels matrix, fuels other than conventional gasoline are converted to a gasoline gallon equivalent (gge) based on energy content and are then taxed at the same rate as gasoline. One gallon of gasoline contains 0.114 MMBtu's and is taxed at a rate of $0.277 /gallon in Vermont. Energetically, one gallon of gasoline is equivalent to 33.41 kWh, which under this system would be taxed at a rate of $0.008/kWh:

(1 gallon gasoline/ 33.41 kWh) * ($0.277/gallon) = $0.008/kWh

One gallon of gasoline is energetically equivalent to 126.7 ccf CNG, which on a gge basis would be taxed at a rate of $0.218/ 100 ccf:

(1 gallon gasoline / 126.7 ccf CNG) * (0.277/gallon) = 0.218 ¢ / 100 ccf

Federal transportation tax rates on CNG are set using this methodology, generating funds that by law should be routed to the federal highway trust fund.

Vehicle Miles Traveled-based Fee

$0.013/mile flat rate would achieve revenue neutrality:

$146 / 12,700 annual miles driven/vehicle = $0.011/mile

However, based on 2009 survey data from the Federal Highway Administration (http://nhts.ornl.gov), we estimate that the average vehicle in Vermont drives closer to 11,575 miles annually and that approximately 10% of the annual VMT driven in Vermont is driven by out of state vehicles. An odometer-based VMT system for Vermont would have no means of taxing vehicles not registered in the state. *Revenue neutrality to make-up for this discrepancy would require a VMT fee of $0.013/mile.*

Other states have proposed fees ranging from $0.17-$0.24/mile which include additional time of use and congestion fees

Section 39 Study Group Membership

Members

The Secretary of Transportation or designee - Chris Cole
Joint Fiscal Office - Steve Klein and Neil Schickner
Commissioner of Motor Vehicles - Rob Ide
Commissioner of Taxes - Jeffrey Dooley
Commissioner of Public Service or designee - Asa Hopkins

In addition we'd like to acknowledge Justin Johnson and Dick Valentenitti from the Agency of Natural Resources, Joe Segale, Gina Campoli from the Agency of Transportation and Shannon Fassett from the Department of Motor Vehicles for their participation and valuable contributions.