



A Report from the University of Vermont Transportation Research Center

The Vermont Transportation Energy Report: Vermont Clean Cities Coalition

The Vermont Transportation Energy Report

Vermont Clean Cities Coalition

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Disclaimer

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1. Introduction

The mission of the Vermont Clean Cities Coalition (VCCC) is to reduce the state's reliance on fossil fuels for transportation. This annual report provides policy makers with relevant and timely data on the status of fuel consumption, vehicle purchases, transportation expenditures, and travel behavior. This information is intended to form the basis of data-driven policy discussions and initiatives.

The VCCC is funded by the U.S. Department of Energy and the Vermont Department of Public Service. The University of Vermont Transportation Research Center has served as the host of the VCCC since July 2007. Nationwide, there are 87 local Clean Cities Coalitions in 45 states. VCCC stakeholders include fleet managers, state and local officials, auto dealers, students, and academics.

The transportation sector is the largest energy user in Vermont, and thus a primary focus when it comes to reducing the state's energy and fossil fuel use (Figure 1-1). The residential sector closely follows as the second largest energy consumer in the state.

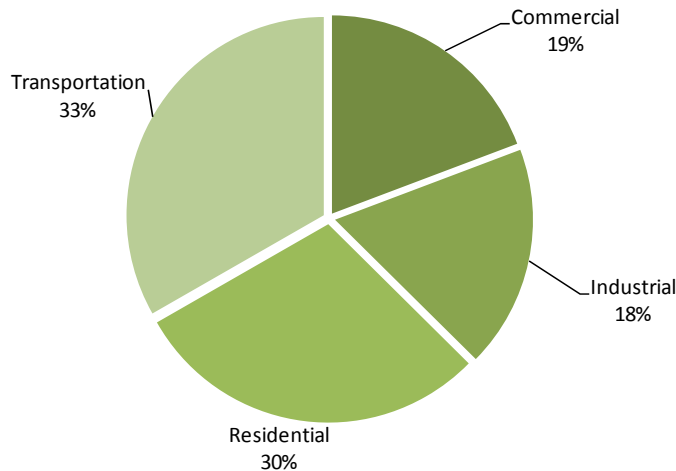


Figure 1-1. Vermont Energy Use by Sector, 2007 ^[1]

In the U.S. as a whole and in most states, the industrial sector is generally the largest single consumer of energy (Figure 1-2). Vermont's total energy usage ranks 43rd in the nation.

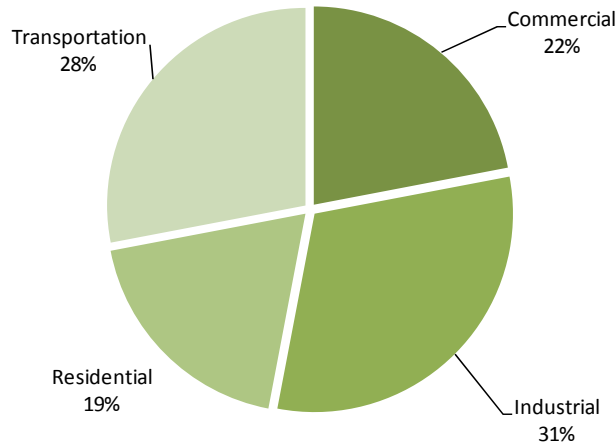


Figure 1-2. U.S. Energy Use by Sector, 2008 ^[2]

Energy use is of course closely linked to greenhouse gas (GHG) emissions. Electricity generation makes up 32% of total U.S. GHG emissions, ^[3] but only a small portion of Vermont's emissions (approximately 0.1% in 2007).^[4] The bulk of Vermont's electricity comes from the Vermont Yankee nuclear power plant and hydropower imported from the Canadian utility Hydro Quebec, two energy sources emitting relatively low levels of greenhouse gases (GHGs).

Approximately 20 pounds of carbon dioxide (CO₂) is produced for every gallon of gasoline consumed.^[5] The transportation sector contributed 57% of Vermont's GHG emissions in 2007.^[4] In contrast, nationally, transportation accounts for 33% of the GHG emissions from fossil fuel combustion.^[3] The large percentage of emissions generated by the transportation sector in Vermont makes it an important policy focus within the state.

In this report, we focus on factors that impact transportation energy demand, including trends in vehicle fleet composition and Vermonters' travel patterns. Last year, we reported that 2008 saw substantial increases in energy expenditures by both consumers and government programs (including Medicaid and the Department of Education). Last year's report also showed that while Vermonters are highly dependent on their personal vehicles, the overall fuel efficiency of the Vermont fleet appeared to be increasing and total Vehicle Miles Traveled (VMT) in the state declined. In this year's report, we show that in 2009, consumer spending on transportation dropped, presumably due to lower fuel costs, although expenditures by government agencies increased. In 2009, both VMT and the number of hybrid vehicles registered in Vermont increased.

2. Gasoline and Diesel Sales

Fuel sales for highway modes in Vermont in 2009 were similar to 2008 levels (Table 2-1). Approximately 85% of fuel sold was gasoline, the bulk of which is presumably used for personal travel.

Estimates of 2009 biodiesel sales in Vermont were not available at the time this report was written. Currently, much of the biodiesel used in the state is blended with heating oil and used for residential and commercial purposes.^[6]

Table 2-1. Gasoline and Diesel Sales in Vermont (million gallons)

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|---------------------------------|------|------|------|------|------|
| Gasoline ^[7] | 361 | 344 | 348 | 337 | 337 |
| Diesel ^[7] | 68 | 72 | 70 | 64 | 59 |
| Biodiesel ^[8] | 0.28 | .80 | 1.14 | 1.25 | -- |
| Total | 429 | 418 | 418 | 401 | 396 |

Both gasoline and diesel prices spiked in the summer of 2008 in Vermont, and fluctuated by over \$1.25 over the course of the year. In 2009, price fluctuations were less dramatic (~\$0.50) and rose fairly steadily over the course of the year, from \$1.73 to \$2.71 (Table 2-2).

Table 2-2. Average Annual Costs of Petroleum in Vermont, 2005-2009^[9]

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------------|--------|--------|--------|--------|--------|
| Gasoline Price/Gallon | \$2.31 | \$2.59 | \$2.81 | \$3.35 | \$2.34 |
| Diesel Price/Gallon | \$2.58 | \$2.86 | \$3.02 | \$4.13 | \$2.70 |

Gasoline prices in Vermont have been similar to or slightly below the national average in the past five years, while diesel prices in Vermont have been consistently above the national average (Table 2-3). In Vermont, prices of B-5 blends (5% biodiesel, 95% conventional diesel) are generally three to five cents higher than conventional diesel.

Table 2-3. Average Annual Costs of Petroleum in the U.S., 2005-2009 ^[10, 11]

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|------------------------------|--------|--------|--------|--------|--------|
| Gasoline Price/Gallon | \$2.31 | \$2.62 | \$2.84 | \$3.29 | \$2.41 |
| Diesel Price/Gallon | \$2.40 | \$2.71 | \$2.89 | \$3.81 | \$2.47 |

Total annual spending on gasoline and diesel declined in 2009, from \$1.3 billion in 2008 to \$941 million in 2009 (Figure 2-1). With the exception of state taxes and a small margin of profit retained by gas stations, the bulk of these dollars are exported out of the state. In Vermont, each gallon of gas is taxed an average of 42.9 cents per gallon, including federal taxes of 18.4 cents per gallon. Diesel is taxed at a higher rate, 53.4 cents per gallon in Vermont, which includes a 24.2-cent federal tax. ^[12]

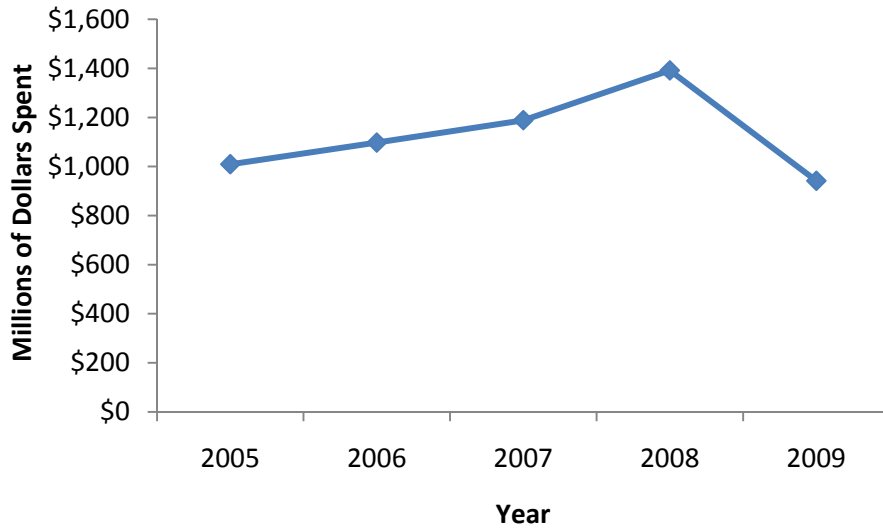


Figure 2-1. Total Annual Spending on Gasoline and Diesel in Vermont, 2005-2009 ^[7, 9]

3. Vehicle Fleet and Travel Patterns

3.1. Vehicle Fleet

Vermont's petroleum usage is directly related to the fuel efficiency of the state's vehicle fleet, the number of vehicles in use, and the number of miles that those vehicles travel. One goal of this report is to track trends in vehicle fleet efficiency, including the number of hybrid vehicles in use in the state. As shown in Table 3-1, the ratio of vehicle per licensed driver increased in Vermont in 2009 because the number of drivers declined more dramatically than the number of registered vehicles.

Table 3-1. Vehicle Registrations and Driver's Licenses in Vermont, 2005-2009

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---------|---------|---------|---------|---------|
| Vehicle Registrations* ^[13] | 573,470 | 575,163 | 574,370 | 569,728 | 568,468 |
| Driver's Licenses ^[14] | 561,338 | 532,041 | 538,372 | 545,336 | 509,317 |
| Vermont Population ^[15] | 619,736 | 620,778 | 621,254 | 621,270 | 621,760 |
| Vehicles per Licensed Driver | 1.02 | 1.08 | 1.08 | 1.04 | 1.12 |
| Vehicle per Capita | 1.08 | 1.08 | 1.08 | 0.92 | 0.91 |

**Registrations include state vehicles, municipal vehicles, trucks, and autos. This table does not include bus, agricultural vehicle dealers, handicap placard, motorcycle, or trailer registration.*

According to Vermont DMV data, the number of vehicles registered to new owners in 2009 declined relative to 2008 (Figure 3-1). New vehicle registrations declined from 32,698 in 2008 to 22,111, while the number of used vehicle registrations increased from 59,866 to 64,558. New vehicle sales continued to drop in 2009, while used vehicle sales increased (Figure 3-1). Overall sales were lower in 2009 relative to 2008 (86,673 versus 92,564). Vehicles purchased in their model year or later were assumed to be new purchases and all others were assumed to be used purchases, e.g., for 2009, all 2009 and 2010 vehicle models were assumed to be new purchases while all earlier models were assumed to be used vehicles.

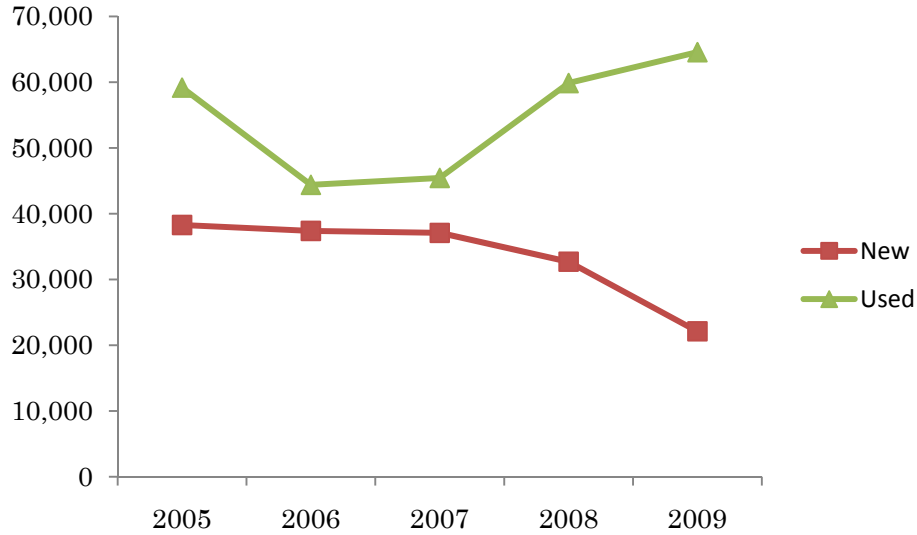
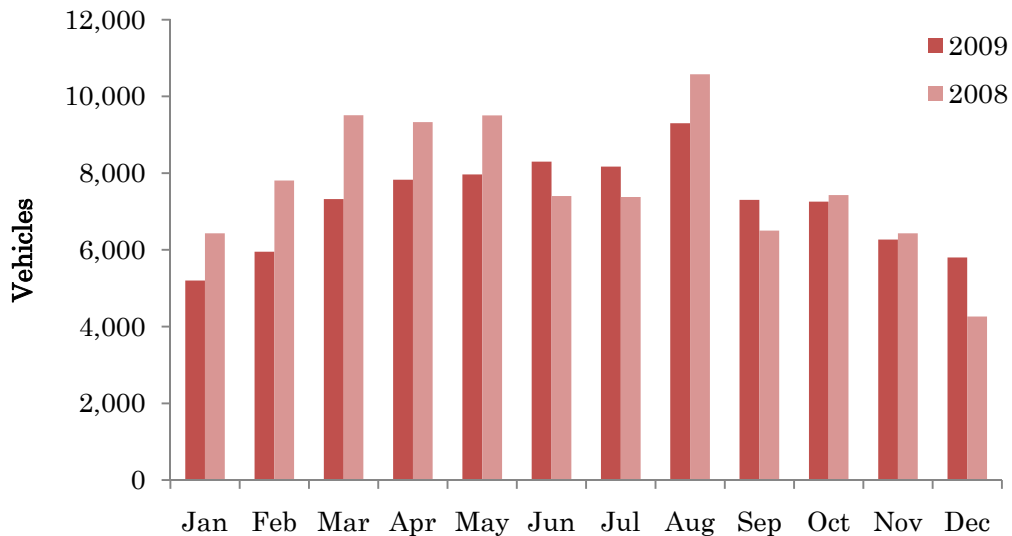


Figure 3-1. Newly Registered Vehicles in Vermont, 2005-2009 [16]

In July 2009, the U.S. Congress passed legislation implementing the Car Allowance Rebate System, or “Cash for Clunkers”, which provided car buyers with a \$3,500 to \$4,500 rebate if they traded in an old vehicle that achieved 18 mpg or less, and bought a new vehicle that was at least 4 mpg more fuel efficient. The program ran July 1 through November 1, 2009. [17] There was a peak in car sales in Vermont in August 2009, although the overall seasonal trend of this period is similar to that in 2008 (Figure 3-2).

Figure 3-2. Number of Vehicles Purchased in Vermont in 2008 and 2009 [16]



A variety of vehicle fuel types are now available to Vermont consumers, including hybrid and flex fuel vehicles, in addition to conventional gasoline vehicles. Hybrid vehicles continue to comprise only a small portion of the Vermont fleet, although that portion has grown consistently since 2006 (Tables 3-2 and 3-3). Hybrid vehicles comprised 4% of new vehicle

purchases in 2009 and 1% of the total Vermont fleet. Flex fuel vehicles are those that can run on either gasoline or a gasoline/ethanol mixture of up to 85% ethanol. Although most car manufacturers now offer multiple flex fuel models, the Vermont DMV does not classify gasoline and flex fuel vehicles separately so these vehicles types are grouped together in Table 3-2. Currently, there are no commercial suppliers of ethanol in Vermont.

Table 3-2. New and Used Vehicle Purchases in Vermont by Fuel Type, Percent of Total Sold ^[16]

| Fuel | 2007 | | 2008 | | 2009 | |
|---|------|------|------|------|------|------|
| | New | Used | New | Used | New | Used |
| Gasoline (includes Flex Fuel vehicles) | 94% | 98% | 96% | 99% | 95% | 99% |
| Diesel | 2% | 2% | 1% | 1% | 1% | <1% |
| Hybrid | 3% | <1% | 3% | <1% | 4% | <1% |
| Electric | <1% | <1% | <1% | <1% | <1% | <1% |
| Other | <1% | <1% | <1% | <1% | <1% | <1% |

Table 3-3. All Vehicles Registered in Vermont by Fuel Type ^[18]

| Fuel | 2006 | 2007 | 2008 | 2009 | Percent Change 2005-2009 |
|-----------------|---------|---------|---------|---------|--------------------------|
| Hybrids | 2,358 | 3,651 | 4,565 | 5,473 | 132% |
| Electric | 110 | 106 | 101 | 94 | -14% |
| Propane | 110 | 93 | 75 | 69 | -37% |
| Diesel | 29,161 | 31,648 | 32,140 | 30,724 | 5% |
| Gasoline | 542,126 | 583,568 | 578,881 | 528,930 | -2% |

As shown in Table 3-4, the number of hybrids purchased over the past five years has increased, peaking in 2009 with 1,265 purchased.

Table 3-4. New Hybrid Electric Vehicle Purchases in Vermont by Model, 2005-2009 ^[16]

| Model | 2005 | 2006 | 2007 | 2008 | 2009 | Total Sold Over 5 Years |
|------------------|------------|------------|--------------|------------|--------------|-------------------------|
| Lexus 250 | -- | -- | -- | -- | 2 | 2 |
| 4 Runner | -- | -- | -- | -- | 1 | 1 |
| Accord | 34 | 13 | 6 | 2 | 5 | 60 |
| Altima | -- | -- | 16 | 27 | 34 | 77 |
| Aura | -- | -- | 4 | 2 | 1 | 7 |
| Camry | -- | 70 | 123 | 78 | 42 | 313 |
| Civic | 96 | 91 | 111 | 104 | 79 | 481 |
| Escape | 70 | 44 | 30 | 18 | 56 | 218 |
| Fusion | -- | -- | -- | -- | 40 | 40 |
| GS | -- | -- | 1 | -- | -- | 1 |
| Highlander | 78 | 160 | 97 | 61 | 88 | 484 |
| Insight | 3 | 5 | -- | -- | 66 | 73 |
| Lexus L45 | -- | -- | -- | -- | 7 | 7 |
| Lexus LS | -- | -- | -- | 1 | -- | 1 |
| Malibu | -- | -- | -- | 8 | 8 | 16 |
| Milan | -- | -- | -- | -- | 4 | 4 |
| Mariner | 1 | 6 | 12 | 7 | 7 | 33 |
| Prius | 405 | 503 | 815 | 648 | 785 | 3,156 |
| Lexus RX300-400h | 18 | 13 | 21 | 9 | 11 | 72 |
| Sienna | -- | -- | -- | -- | 1 | 1 |
| Tahoe | -- | -- | -- | 5 | 12 | 17 |
| Vue | -- | 1 | 19 | 3 | 12 | 35 |
| Yukon | -- | -- | -- | 1 | 4 | 5 |
| Total | 705 | 906 | 1,255 | 974 | 1,265 | 5,109 |

The spatial distribution of hybrids is not uniform throughout the state, as shown in Figure 3-3. As of July 2010, the proportion of hybrid ownership was highest in Chittenden County, where hybrids comprised 1.5% of all registered vehicles. Essex County had the smallest proportion of registered hybrids (0.3%).

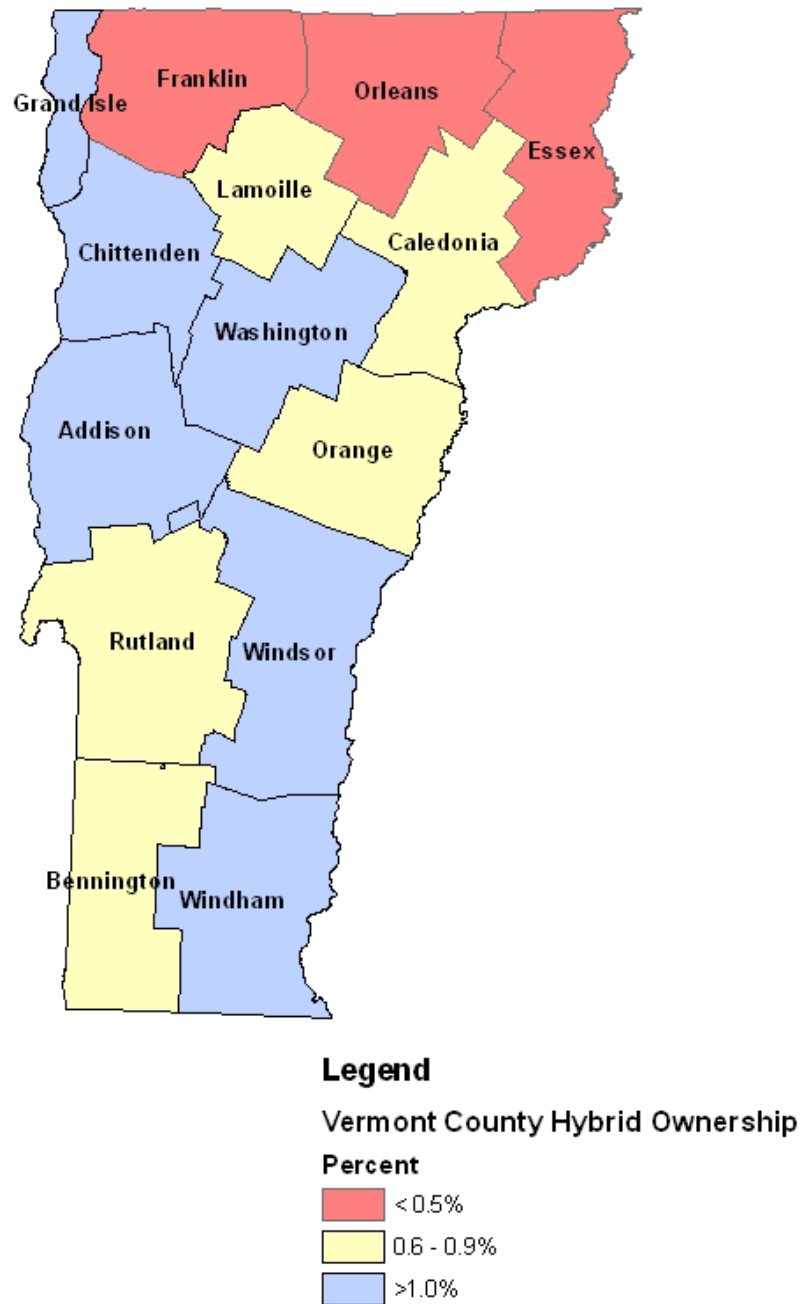


Figure 3-3. Hybrid Ownership by Vermont County, 2010 ^[16]
 (percent of total registered vehicles)

Sport utility vehicles comprised the largest component of new vehicles purchased in 2009 (Table 3-5). This share appears to have grown since 2008, when SUV's comprised approximately 25% of new vehicle purchases. The percentage of new pickup trucks purchased has declined substantially since 2008, from 16.4% to less than 1% in 2009.

Table 3-5. Vehicle Class of New Vehicles Purchased in Vermont, 2009 ^[16]

| Vehicle Class | % New Vehicle Purchases in 2009 |
|--|--|
| Economy (such as Honda Civic, VW Rabbit) | 35% |
| Midsized & Large Sedan (such as Toyota Camry, Ford Fusion) | 24% |
| Pickup Truck | < 1% |
| S.U.V., Minivan & Van | 40% |
| Other | 1% |

When calculating the cost of owning a vehicle, people often only consider vehicle purchase price and fuel costs. However, when factors such as maintenance, depreciation, and insurance are also accounted for, this value grows substantially. Each year, AAA estimates the total cost of car ownership (Table 3-6). For 2008, this cost was estimated to vary between \$6,230 for a small sedan and \$10,448 for an SUV.

Table 3-6. Annual Vehicle Ownership and Operating Expenses, 2008 ^[19]

| Type of Cost | Small Sedan | Medium Sedan | Large Sedan | Sport Utility Vehicle | Minivan |
|---|-------------|--------------|-------------|-----------------------|---------|
| Gas and Oil/Mile | 9.4 ¢ | 12.3 ¢ | 13.3 ¢ | 17.1 ¢ | 14.0 ¢ |
| Maintenance/Mile | 4.0 ¢ | 4.7 ¢ | 5.1 ¢ | 5.5 ¢ | 4.8 ¢ |
| Tires/Mile | 0.6 ¢ | 0.9 ¢ | 0.8 ¢ | 0.9 ¢ | 0.7 ¢ |
| Operating Costs/Mile | 13.9 ¢ | 17.9 ¢ | 19.1 ¢ | 23.5 ¢ | 19.4 ¢ |
| Insurance | \$949 | \$907 | \$973 | \$888 | \$883 |
| License and Registration | \$410 | \$562 | \$660 | \$715 | \$563 |
| Depreciation | \$2,332 | \$3,355 | \$4,275 | \$4,327 | \$3,511 |
| Finance Charges | \$541 | \$770 | \$963 | \$1,000 | \$771 |
| Ownership Costs per Year | \$4,232 | \$5,594 | \$6,901 | \$6,930 | \$5,278 |
| Total Cost for 15,000 Miles per Year | \$6,320 | \$8,273 | \$9,769 | \$10,448 | \$8,644 |

3.2. Vehicle Miles Traveled in Vermont

Total annual vehicle miles traveled (VMT) are important data for highway planning and management, as well as being a common measure of roadway use. Along with other data, VMT are often used in estimating congestion, air quality, and potential gasoline tax revenues, and can provide a general measure of the level of the nation's economic activity.

VMT is one of the three factors examined in this report that affect vehicle energy use (the other two being the number of vehicles in use and vehicle fuel economy). As Table 3-7 shows, VMT increased between 2008 and 2009 in both Vermont and the nation as a whole. Reducing VMT would clearly reduce energy use, but alternatives for travel, especially in a rural state, are limited.

**Table 3-7. Vermont and U.S. Annual Vehicle Miles Traveled by Calendar Year
(in millions), 2005-2009**

| | 2005 | 2006 | 2007 | 2008 | 2009 |
|--------------------------------|-----------|-----------|-----------|-----------|-----------|
| Vermont ^[20] | 7,611 | 7,688 | 7,529 | 7,126 | 7,537 |
| U.S. ^[21] | 2,971,785 | 3,004,246 | 3,009,492 | 2,923,205 | 2,979,394 |

Annual estimates of VMT are made by VTrans each year, based on counts of cars. As might be expected, Chittenden County, the most populous county in Vermont, was estimated to have the highest total annual VMT in 2009 (Figure 3-3).

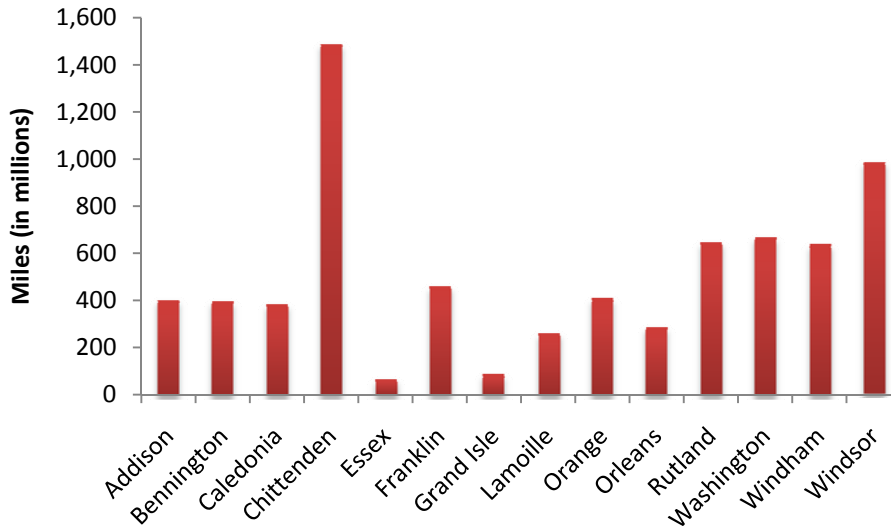


Figure 3-4. Vehicle Miles Traveled by Vermont County, 2009 ^[20]

When scaled to population, county-level differences in VMT are less dramatic (Figure 3-5).

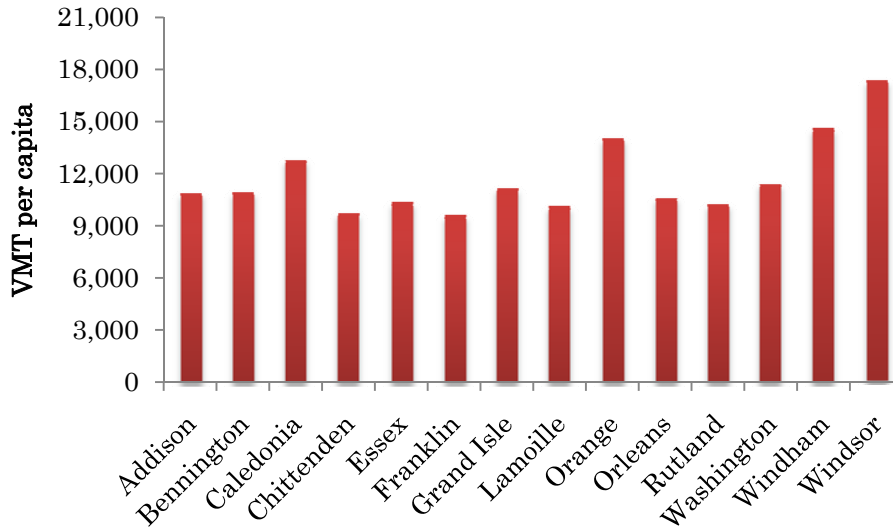


Figure 3-5. Per Capita Vehicle Miles Traveled by Vermont County, 2009 [15, 20]

VMT per driver increased between 2007 and 2009, due to increased VMT and a decline in the number of licensed drivers in Vermont (Table 3-8).

Table 3-8. Vehicle Miles Traveled per Licensed Driver [13, 20]

| Year | VMT per Licensed Driver |
|------|-------------------------|
| 2007 | 13,967 |
| 2008 | 13,159 |
| 2009 | 14,798 |

3.3. 2009 National Household Transportation Survey

In 2009, the U.S. Department of Transportation performed a National Household Transportation Survey (NHTS), which is a comprehensive survey of personal travel patterns. In Vermont, approximately 1,600 households were surveyed, with data collected from at least 22 households in every county. These survey data provide information on Vermonters’ travel patterns and allow us to assess how energy is used within the transportation sector and how different modes of transport (biking, walking, and public transport) can be used to reduce driving. [22]

Journey-to-Work

44% of Vermont respondents reported a journey-to-work length of five miles or less (Figure 3-6). People with short commutes may be strong candidates for using other modes of transport. Based on NHTS respondents, mean one-way journey-to-work distance for the state is

estimated to be 13 miles. According to 2000 U.S. Census data, journeys to and from work comprised 22% of all trips.

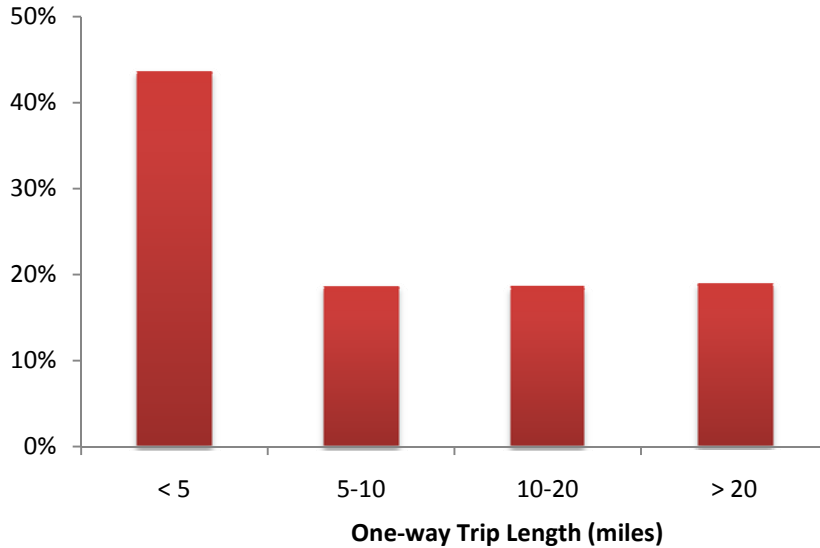


Figure 3-6. Vermonter Journey-to-Work Trip Length

As shown in Table 3-9, the majority of those Vermonters surveyed reported getting to work via a personal vehicle.

Table 3-9. Journey-to-Work Travel Mode

| Mode | Percent Surveyed |
|------------------|------------------|
| Personal Vehicle | 94% |
| Bus | <1% |
| Bike | 1% |
| Walk | 3% |

We also examined the length of Vermonters’ journey-to-work (one-way) by county. As shown in Table 3-10, the shortest mean commute length was reported in Rutland County (7.2 miles), followed by Windham County (7.3 miles). The longest mean commute length was reported in Grand Isle County (15.9 miles) and was nearly double that of Rutland County. Lamoille County also reported a relatively high commute length at 14.9 miles. Despite these substantial differences observed in journey-to-work trip length, as noted earlier, overall VMT per capita among counties was similar (Figure 3-5).

Table 3-10. Mean Commute Length by County

| County | Mean Commute Length (miles) | Sample size | Per cent of VT population |
|------------|-----------------------------|-------------|---------------------------|
| Addison | 14.4 | 72 | 5.9 |
| Bennington | 8.2 | 88 | 5.9 |
| Caledonia | 9.3 | 70 | 4.9 |
| Chittenden | 9.1 | 503 | 24.5 |
| Essex | 10.7 | 21 | 1.0 |
| Franklin | 12.2 | 118 | 7.7 |
| Grand Isle | 15.9 | 31 | 1.2 |
| Lamoille | 14.9 | 78 | 4.2 |
| Orange | 11.6 | 44 | 4.6 |
| Orleans | 10.9 | 82 | 4.4 |
| Rutland | 7.2 | 133 | 10.1 |
| Washington | 8.8 | 116 | 9.4 |
| Windham | 7.3 | 94 | 7.0 |
| Windsor | 9.6 | 159 | 9.1 |
| | Total | 1,609 | 100 |

Vehicle Occupancy in Vermont

Vehicle occupancy, along with vehicle fuel efficiency and miles traveled is a fundamental aspect of overall transportation efficiency and energy use. The majority of trips in personal vehicles in Vermont are single occupancy. Increasing vehicle occupancy is one of the simplest ways to decrease energy use by the transportation sector and requires no new infrastructure. Based on the NHTS results for Vermont, mean vehicle occupancy was estimated to be 1.5 people per car for the state. This average is lower than the national average of 1.6 people per car per trip, and may ultimately prove to be a statistically significant difference.

In Vermont, vehicle occupancy varied by trip purpose, with 90% of journeys to and from work transporting only the driver, while 45% of trips for recreation purposes carried at least one passenger. Approximately 53% of trips for religious purposes were single occupancy. Figure 3-7 provides comparisons of energy use per passenger mile for a variety of transport modes and capacities. The majority of trips reported by Vermont survey respondents were taken in personal vehicles (85%).

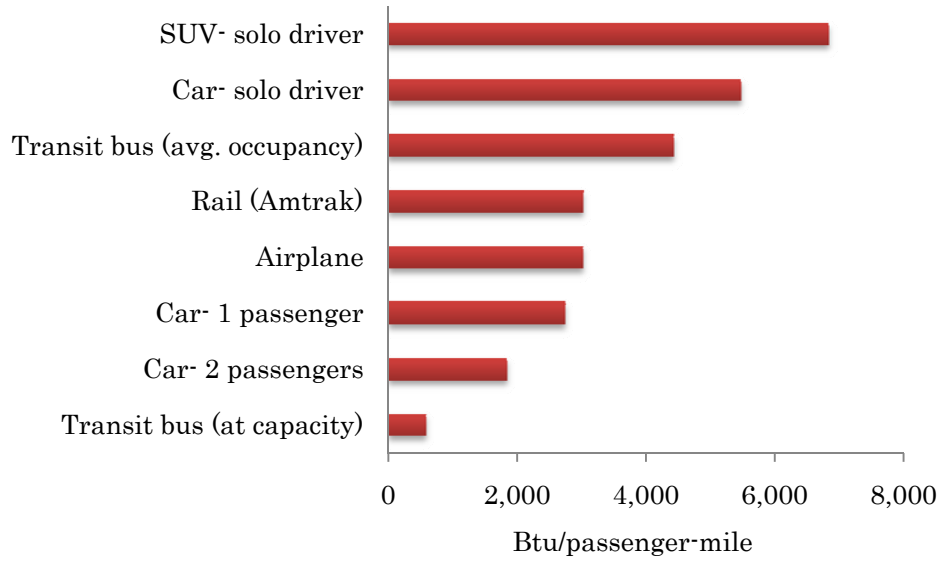


Figure 3-7. Energy Use per Passenger-Mile by Transport Mode and Occupancy ^{[23]*}

*Transit bus average occupancy is assumed to be 9 and bus capacity assumed to be 70. Rail and airplane average capacity are assumed to be 22 and 97, respectively.

4. Programs that Impact Transportation Fuel Use

4.1 State Expenditures on Transportation

Table 4-1 outlines expenditures by the Vermont Agency of Transportation over the previous five years. Overall expenditures have increased over this period, including increases in spending on public transit and bike and pedestrian options. Items in bold are programs and infrastructure that support transport options other than the single occupancy vehicle (SOV), such as Park and Ride facilities and public transit. The combined proportion of budget expenditures on such programs increased from an estimated 7% in 2005 to 11% in 2009.

Table 4-1. Vermont Agency of Transportation Expenditures by Fiscal Year, 2005-2009 ^[24]

| Budget Line Items* | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
|---|----------------|----------------|----------------|----------------|---------------|
| Paving and Maintenance | 27 % | 28 % | 29 % | 33 % | 34 % |
| Roadway | 16 % | 15 % | 14 % | 10 % | 9 % |
| Bridges (incl. Maintenance) | 10 % | 8 % | 9 % | 6 % | 7 % |
| Town Programs | 16 % | 15 % | 17 % | 17 % | 16 % |
| Finance, Planning, DMV | 11 % | 11 % | 12 % | 12 % | 11 % |
| Public Transit | 4 % | 4 % | 4 % | 5 % | 5 % |
| Pedestrian and Bike | 1 % | 1 % | 1 % | <1 % | 1 % |
| Park and Ride | <1 % | <1 % | <1 % | <1 % | 1 % |
| Multi-Modal | <1 % | <1 % | <1 % | 0 | <1% |
| Rail | 2 % | 2 % | 3 % | 3 % | 3 % |
| Total Transportation Expenditures (in millions) | \$328 | \$338 | \$388 | \$385 | \$395 |
| Percent Budgeted to Non-SOV Options | 7 % | 8 % | 8 % | 9 % | 11 % |

**Items in bold within the table are considered line items for alternatives to the SOV. This table does not include all budget categories.*

The Office of Vermont Health Access (OVHA), part of the Agency of Human Services, also contracts a number of public transit providers for Non-Emergency Medical Transportation (NEMT). NEMT is a covered service for eligible beneficiaries enrolled in traditional and Primary Care Plus Medicaid and the Dr. Dynasaur programs. As shown in Table 4-2, transportation spending by OVHA increased steadily between 2005 and 2009. Some of this is due to increased mileage rates paid to volunteer drivers, beginning in 2007.

Table 4-2. Medicaid Transportation Expenditures, FY 2005-2009 ^[24]

| | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 |
|---------------------|-------------|-------------|-------------|--------------|--------------|
| Expenditures | \$6,722,540 | \$9,424,484 | \$9,900,218 | \$10,663,296 | \$11,878,180 |

4.2. Transport of Pupils to School

The Department of Education tracks transportation expenditures, as well as the number of school buses and miles traveled by those buses. Between the 2008 and 2009 school years, the number of buses declined while miles traveled increased. As shown in Table 4-3, total expenditures have increased steadily since 2004, presumably due to increased fuel costs and miles traveled. School expenditures on transportation have increased despite an increasing percentage of students traveling to school via personal vehicle.

Table 4-3. School Bus Transportation Data, 2004-2009 ^[25]

| | 2004-2005 | 2005-2006 | 2006-2007 | 2007-2008 | 2008-2009 | Percent Change 2004- 2009 |
|--|--------------|--------------|--------------|--------------|--------------|------------------------------|
| Number of School Buses | 1,099 | 1,194 | 1,084 | 1,176 | 1,103 | 0.3% |
| Number of School Bus Miles Traveled | 12,986,370 | 12,199,177 | 10,902,941 | 12,103,914 | 13,575,807 | 4.5% |
| Total Expenditures | \$41,164,027 | \$42,243,897 | \$44,684,921 | \$48,388,374 | \$50,204,260 | 22.0% |

Safe Routes to School Program

The Safe Routes to School Program (SRTS) aims to increase the number of children biking and walking to school through education and by removing barriers that may prevent such modes of transport, including lack of or unsafe infrastructure, such as sidewalks, bike lanes, crossing guards. The program focuses on kindergarten through Grade 8 and provides a way to reduce VMT and improve public health. Nationwide, rates of biking and walking to school have declined dramatically in the past few decades and rates of children being driven to school by parents have increased.

The Vermont SRTS program funds projects throughout the state, including surveys, pedestrian and bike safety education, and pedestrian and bike infrastructure. This program has received approximately \$1,000,000 in federal funding each year between 2005 and 2009. Since 2006, a total of 70 schools have participated in the program. In 2010, an estimated \$1.3 million dollars in infrastructure grants was awarded to 22 Vermont schools. Baseline survey

data collected from students at schools participating in the SRTS program in 2006 is presented in Table 4-4. ^[26]

Information on journeys to school for Vermont students is also available through the 2009 NHTS and shown in Table 4-4. A total of 271 survey respondents under 18 reported information about their journeys to school. The mean journey-to-school distance was 6.9 miles. Rates of biking, walking, and school bus ridership reported by the NHTS were all lower than those reported in the SRTS surveys. These data are not directly comparable due to differing survey methodologies but together are intended to provide some indication of how Vermont's students travel to school.

Table 4-4. Journey-to-School Transport Mode

| Transport Mode | 2006 SRTS Survey | 2009 NHTS |
|-----------------------|-------------------------|------------------|
| Walk | 13% | 5% |
| Bike | 3% | 0% |
| School Bus | 41% | 34% |
| Family Vehicle | 39% | 58% |
| Carpool | 4% | N/A |
| Transit | <1% | <1% |
| Other | <1% | 1% |

4.3. Transit Ridership

A variety of public transit options are available to Vermonters throughout the state. Due to low population density, however, these services generally run on limited schedules. As documented in Table 4-5, ridership fluctuated dramatically and inconsistently among the various transit providers, due to in large part to changes in the services offered by each provider. Note that estimates were not available for all providers.

Table 4-5. Bus Ridership for Vermont Transit Providers, FY 2005-2009 ^[27]

| Transit Provider | FY 2005 | FY 2006 | FY 2007 | FY 2008 | FY 2009 | Percent Change FY 2005-2009 |
|---|-----------|-----------|-----------|-----------|-----------|-----------------------------|
| Chittenden County Transportation Authority | 1,887,104 | 2,009,371 | 2,120,751 | 2,233,481 | 2,512,666 | 33% |
| Green Mountain Transit Agency | 228,490 | 237,287 | 243,244 | 297,160 | 339,345 | 48% |
| Addison County Transit | -- | 109,282 | 117,860 | 124,337 | 123,277 | 13% |
| Advance Transit (Fixed Route) | 300,419 | 353,536 | 389,367 | 456,393 | 484,000 | 61% |
| Brattleboro Beeline | 43,866 | 50,652 | 57,800 | -- | 47,753 | 8% |
| Connecticut River Transit | 24,297 | 34,066 | 39,408 | 52,391 | -- | -- |
| Deerfield Valley Transit | 177,528 | 199,410 | 182,286 | 207,835 | 227,017 | 28% |
| Green Mountain Community Network (Started 2007) | -- | -- | -- | 58,396 | -- | -- |
| Marble Valley Regional Transit District | 830,765 | 751,311 | 628,882 | 597,277 | 584,999 | -30% |
| Rural Community Transit | 162,003 | 208,329 | 215,692 | 239,537 | -- | -- |
| Stagecoach | 90,572 | 93,708 | 95,476 | 97,681 | 58,184 | -36% |

4.4. Highway Transportation Modes

Highway transportation modes include all motor vehicles that are operated on roads, including personal vehicles, trucks, and buses. Non-highway modes include trains, planes, ferries/boats, and non-motorized transportation, such as walking and biking.

Federal Stimulus Funds

VTrans has budgeted \$137 million in federal stimulus money from the American Recovery & Reinvestment Act, \$126 million of which has been awarded. One percent of the \$137 million is slated to be used for bike and pedestrian projects and 4% for public transit. The bulk of this money will be devoted to paving projects. ^[28]

Park and Ride Facilities

Park and Ride facilities give Vermonters another choice of transport mode, providing a safe, free parking spot where cars can be left by those who carpool or take the bus. Every November, occupancy is assessed at most Park and Ride facilities in order to evaluate how heavily this resource is being used (Table 4-6). Occupancy rates tend to be high, suggesting that if the infrastructure is made available, Vermonters are amenable to carpooling and public transit use. Note that data was not available for all facilities.

Table 4-6. Park and Ride Parking Lot Capacity, 2009 ^[29]

| Facility | Percent Capacity | | | |
|-------------------------|------------------|------|------|------|
| | 2006 | 2007 | 2008 | 2009 |
| Barre Town (East) | | | 10% | 20% |
| Barre Town (South) | 47% | 50% | 82% | -- |
| Berlin | 57% | 78% | 68% | 38% |
| Bradford | 78% | 135% | 117% | 79% |
| Bristol | 20% | 30% | 50% | 104% |
| Cambridge | 32% | 37% | 37% | 70% |
| Charlotte | | | | 53% |
| Colchester | 29% | 44% | 46% | -- |
| Ferrisburgh - Vergennes | | 17% | 25% | 18% |
| Georgia | | 92% | 92% | 102% |
| Hartland | 73% | 63% | 70% | 78% |
| Manchester | 7% | 10% | 3% | 3% |
| Middlesex | 50% | 46% | 63% | 46% |
| Montpelier | 45% | 58% | 69% | 44% |
| Morrisville-Stowe | 17% | 50% | | 83% |
| Randolph* | 140% | 133% | 24% | 28% |
| Richmond | 108% | 103% | 143% | -- |
| Royalton | 27% | 40% | 87% | 27% |
| Sharon | 75% | 83% | 92% | 104% |
| Springfield | 188% | 167% | 196% | 133% |
| St. Albans | 53% | 55% | 77% | 74% |
| St. Johnsbury | 60% | 37% | 60% | 51% |
| Thetford | 16% | 40% | 48% | 48% |
| Waterbury | 53% | 65% | 103% | 80% |
| Weathersfield | 102% | 120% | 136% | -- |
| West Danville | 35% | 18% | 41% | 71% |
| Williamstown | 75% | 92% | 71% | 117% |

*In 2008, the Randolph Park and Ride was expanded from 15 to 89 parking spots.

Carpool rates in Vermont, as in the rest of the U.S., have fallen since the 1980's, and are currently estimated at around 12% (down from nearly 20% in 1980).^[30] This decline may be attributed to a number of factors, including increased rates of vehicle ownership, declining household size, relatively low fuel prices, and changing settlement patterns. In 2008, the state of Vermont established GoVermont, an initiative to reduce single occupancy trips through increased carpooling, transit use, biking, and walking. This initiative includes a

website to link potential carpool participants and provide information for those seeking to share rides to work and meetings and conferences.^[31]

Transportation Management Associations (CATMA and UVTMA)

Transportation Management Associations (TMA's) are non-profit organizations that work to meet transportation needs through alternatives to the single occupancy vehicle, including coordination of car- and van-pools. There are two TMA's in Vermont, the Campus Transportation Management Association (CATMA) and the Upper Valley Transportation Management Association (UVTMA). Both of these TMA's are partnerships among some of the state's largest employers (such as Fletcher Allen, UVM, and Dartmouth Hitchcock Medical Center) and coordinate planning and parking needs. Programs provided by the CATMA and UVTMA include coordination of car pools, public transit discounts, and incentives for biking and walking to work for employees at participating entities.

4.5. Eco Driving

"Eco Driving" is a strategy to reduce greenhouse gas emissions, fuel consumption, and crash rates by altering driving style and vehicle maintenance. Eco Driving techniques include driving the speed limit, inflating tires properly, avoiding idling, and keeping excess weight out of the vehicle, among other measures. Eco Driving can result in up to a 33% improvement in gas mileage, as well as a reduction in greenhouse gas emissions, air pollution, dependence on fossil fuels, and the amount of money spent on fuel. The Vermont Clean Cities Coalition, housed at the UVM Transportation Research Center, launched an Eco Driving Initiative in 2010. As of September 2010, an estimated 200 drivers will have been trained in Eco Driving techniques through 18 workshops.^[32]

5. Non-Highway Modes

5.1. Aviation and Rail

There are 16 airports currently operating in Vermont. Ten are state-owned, one is municipally-owned, and five are private.^[33] Commercial airlines fly in and out of the Burlington International Airport (BTV) in Burlington and the Southern Vermont Regional Airport in Rutland. Seven commercial airlines currently operate out of BTV. Table 5-1 indicates the number of passenger enplanements and deplanements from 2005 to 2009. Overall passenger travel declined substantially in 2009 after peaking in 2008. Fuel use and resulting emissions from air travel is highly variable, depending on weather, wind patterns and occupancy.

Table 5-1. Passenger Enplanements and Deplanements at Burlington International Airport, 2005-2009 ^[34]

| | 2005 | 2006 | 2007 | 2008 | 2009 | Percent Change, 2004- 2008 |
|---------------------|---------|---------|---------|---------|---------|----------------------------|
| Enplanements | 691,585 | 690,568 | 707,395 | 759,021 | 708,341 | 2.4 % |
| Deplanements | 679,949 | 687,172 | 703,350 | 757,942 | 718,567 | 5.7 % |

More than 15 operators also move freight through BTV. Table 5-2 indicates that the amount of freight exiting the state decreased by 56 percent, whereas total freight entering the state increased by 37 percent from 2007 to 2009 (these values do not include mail transport).

Table 5-2. Freight Enplanements and Deplanements at Burlington International Airport in Pounds, 2007-2009 ^[34]

| | 2007 | 2008 | 2009 | Percent Change, 2006-2008 |
|---------------------|------------|------------|-----------|---------------------------|
| Enplanements | 8,717,061 | 7,084,389 | 3,790,086 | -56 % |
| Deplanements | 12,723,597 | 13,415,789 | 8,058,694 | 37 % |

As shown in Table 5-3, Amtrak ridership increased substantially between 2005 and 2009, suggesting Vermonters may be seeking alternatives to vehicle and air travel due to high gas prices and increased airport security. On average, the energy efficiency of rail travel is greater than the single occupancy vehicle and comparable to air travel (see Figure 3-7).

Table 5-3. Total Vermont Amtrak Station Boardings and Alightings, FY 2005-2009 ^[35]

| 2005 | 2006 | 2007 | 2008 | 2009 | Percent Change, 2005-2009 |
|--------|--------|--------|--------|--------|---------------------------|
| 57,121 | 64,647 | 72,822 | 82,216 | 82,667 | 44% |

5.2. Walking and Bicycling

Walking and bicycling are among the least energy-intensive modes of travel. In Vermont, there is little data available on these modes of travel. In 2005, the University of Vermont Center for Rural Studies partnered with the Vermont Department of Health to take an inventory of public resources in Vermont municipalities that support and promote public health. Table 5-4 indicates the type of resource, average miles of resource per municipality, and the percent of municipalities providing bicycle or pedestrian resources in Vermont.

Table 5-4. Bicycle and Pedestrian Resources in Vermont Municipalities, 2005 ^[36]

| Public Resource | Average Miles | Percent of Municipalities Providing Resources |
|--|---------------|---|
| Sidewalk | 4.1 | 41.5 % |
| Bicycle Lanes | 0.4 | 8.1 % |
| Off-Road Bicycle/Pedestrian Paths | 1.9 | 21.5 % |
| Foot Paths (Hiking and Walking Trails) | 3.2 | 37.8 % |

Frequencies of walking and bicycling in Vermont were estimated using the 2009 NHTS survey data. Because previous research has suggested that bicycling rates often differ between men and women, we present the survey results for these two groups separately (Table 5-5). Surveys were conducted throughout the year to avoid any seasonal bias.

Almost 30% of women and more than 30% of men reported making at least five walking trips in the previous week. Bicycling rates were considerably lower, with less than 10% of women and 15% of men reporting at least one trip in the previous week. Trips include one-way journeys for any purpose (such as work, recreation, school, shopping, exercise). Prior surveys performed in urban areas have found that women are less likely to travel by bicycle in conditions they deem unsafe due to high traffic volume and/or lack of bicycle lanes.

Table 5-5. Vermonter Bicycling and Walking Trips in the Previous Week ^[37]

| Number of Trips in the Past Week | Men (n=1,673) | | Women (n=1,877) | |
|----------------------------------|---------------|-------|-----------------|-------|
| | Bike | Walk | Bike | Walk |
| 1-2 | 6.9% | 13.8% | 5.2% | 14.3% |
| 3-5 | 4.2% | 21.6% | 3.1% | 27.1% |
| 5+ | 3.6% | 34.5% | 1.5% | 29.8% |

6. Summary

Although updated estimates of sector-specific energy use were not yet available for 2009, the transportation sector presumably continues to be Vermont's largest energy consumer. Fuel sales remained relatively flat between 2008 and 2009, despite decreases in prices of both gasoline and diesel. Expenditures by the Vermont Agency of Transportation totaled nearly \$400 million in 2009. The proportion of funds budgeted to public transit, Park and Ride facilities, and the rail system have increased since 2005, providing Vermonters with increased transport options. The bulk of funds, however, continue to be allocated to paving, and bridge and roadway maintenance.

Total annual vehicle miles traveled (VMT) in Vermont increased in 2009 relative to 2008. National VMT also increased, following a pronounced decline in 2008, although levels have still not returned to those seen in 2007. VMT is often interpreted as an indicator of economic activity. Relatively low VMT in recent years may be symptomatic of the economic recession. On a per-driver basis, VMT in the state has surpassed 2007 levels due to a decline in the number of drivers.

Purchases of hybrid vehicles continued to increase in 2009 and comprised 4% of new vehicle purchases that year. By vehicle class, sport utility vehicles comprised the greatest proportion of new and used vehicle purchases: 40% versus 35% for smaller, economy-sized cars.

The primary mode of transport in the state of Vermont remains the personal vehicle. More than 90% of Vermonters surveyed reported driving to work in a personal vehicle, and only 12% of those surveyed carpool with any regularity. Use of Park and Ride facilities throughout the state has been consistently high, however, suggesting that carpooling is a viable option for many Vermonters. Statewide trends in public transit ridership are difficult to assess due to changes in service among providers. In general, as a relatively rural state with a disperse population, Vermonters continue to be highly reliant on their personal vehicles to meet their transportation needs.

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