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# The Vermont Transportation Energy Report

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A report by the Vermont Clean Cities Coalition & UVM Transportation Research Center

# The Vermont Transportation Energy Report (2008)

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# Vermont Clean Cities Coalition

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## Disclaimer

# Table of Contents

## List of Tables



## List of Figures

# 1. Introduction

The Vermont Clean Cities Coalition's mission to reduce Vermonter's reliance on imported fossil fuel requires that policy makers have at their disposal relevant and timely data. This report presents data on the status of fuel consumption, vehicle purchases and travel behavior that can be used as a basis for policy discussions and initiatives. The Vermont Clean Cities Coalition will continue to provide this data on an annual basis.

The Vermont Clean Cities Coalition (VCCC) is funded by the U.S. Department of Energy and the Vermont Department of Public Service. The UVM Transportation Research Center has served as the Vermont host since July 2007. Nationwide there are almost 90 local coalitions representing more than 5,400 stakeholders. Vermont Clean Cities Coalition stakeholders include fleet managers, state and local officials, auto dealers, students and academics. These stakeholders gathered for their annual roundtable in April 2008. The VCCC produces a bi-weekly electronic newsletter which is distributed to a list of more than 600 e-mail addresses. VCCC also hosts and co-sponsors events around the state.

The transportation sector is the largest user of petroleum in Vermont, consuming more petroleum than any other end user. This report focuses not only on petroleum use but also on the vehicle fleet, travel patterns and programs that affect Vermont's overall petroleum use.

# 2. Transportation Fuel Consumption

## 2.1. Transportation Fuel Sales in Vermont

The transportation sector, which includes personal vehicles, public transit, trucks, rail, maritime and aviation transportation, is the largest user of petroleum in Vermont, consuming more petroleum than any other end user, including the industrial (manufacturing), residential (energy use by homes), and commercial (energy use by commercial buildings) sectors.

As shown in Table 2-1, gasoline sales in Vermont were flat between 2002 and 2007. Diesel sales increased about 5 percent during the same time period. Biodiesel sales have increased sharply since 2004, but they remain a small portion of overall transportation fuel. (These data do not include the personal production of biodiesel.) Biodiesel is not to be confused with ethanol. Although ethanol is sold in the state as an additive to gasoline there are currently no E85 (ethanol) fueling stations in Vermont. Because Vermont imports all of its gasoline and many other states implemented E10 ethanol blend mandates in 2006, a large portion of gasoline sold in Vermont is 10% ethanol. Ethanol production in the U.S. has more than tripled since 2002, increasing from 2,130 million gallons to 6,500 million gallons.[1]

**Table 2-1. Fuel Sold in Vermont for the Transportation Sector (in millions of gallons.)[1]**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Gasoline | 346 | 357 | 355 | 361 | 344 | 348 |
| Diesel | 66.7 | 68.4 | 68.3 | 68.0 | 72.2 | 69.8 |
| Bio-Diesel | N/A | 0.01 | 0.06 | 0.28 | 1.40 | N/A |
| Total | 413 | 425 | 423 | 429 | 418 | 418 |

Figure 2-1 compares monthly gasoline sales for the first four months of 2007 and 2008. It shows that gasoline sales do fluctuate from month to month within a single year, but that overall sales have remained generally flat.

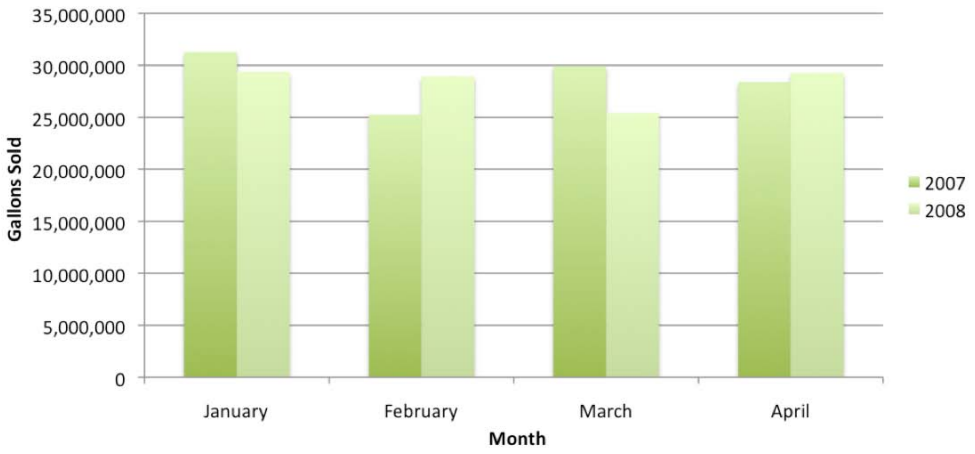


**Figure 2-1. Gasoline Sold in Vermont January through April 2007 and 2008[2]**

In the United States, gallons of gasoline and diesel sold have also remained flat over the past six years. From 2002 to 2007 the percent of change for total U.S. gasoline sales was slightly higher than Vermont at approximately +1.9 percent. There have been no major changes in gasoline sales in Vermont or in the U.S. as a whole. The percent of change in U.S. total gasoline sales from 2005 to 2007 shows that in more recent years sales have decreased slightly with a -0.3 percent change[3]. At both the state and the national levels these trends in gallons of motor gasoline sold has resulted in a decrease in revenue generated by the gasoline tax. Because the gasoline tax is a constant value based on gallons sold and not on the cost per gallon, flat gasoline sales also result in decreased value of the gasoline tax revenues because of inflation.

## 2.2. Transportation Fuel Prices

In 2007, the amount spent on gasoline and diesel purchases in Vermont continued to rise above the $1 billion (see Figure 2-2). At a total expenditure of $1.19 billion in 2007, the amount spent on fuel in Vermont increased by $623 million in 2007 over 2002. In other words, in six years, in-state spending on transportation fuels has doubled while gasoline and diesel fuel use has remained almost the same. Most of these dollars are exported out of state to purchase the fuel: according to the Energy Information Administration, in 2007 for each gallon of gasoline bought in the U.S., 10 percent of the cost was for distribution and marketing, 17 percent for refining costs and profits, 15 percent for Federal and State taxes, and 58 percent for the crude oil). The reason for the increase in spending is the rapid increase in gasoline prices over the last six years.

The increase in petroleum cost is continuing more sharply in 2008. In May, 2008 gasoline prices were already nearly $0.65 more than May, 2007 prices. Figure 2-3 compares gasoline prices for 2008 with prices for the same months in 2007. Prices are higher this year and continue to rise.

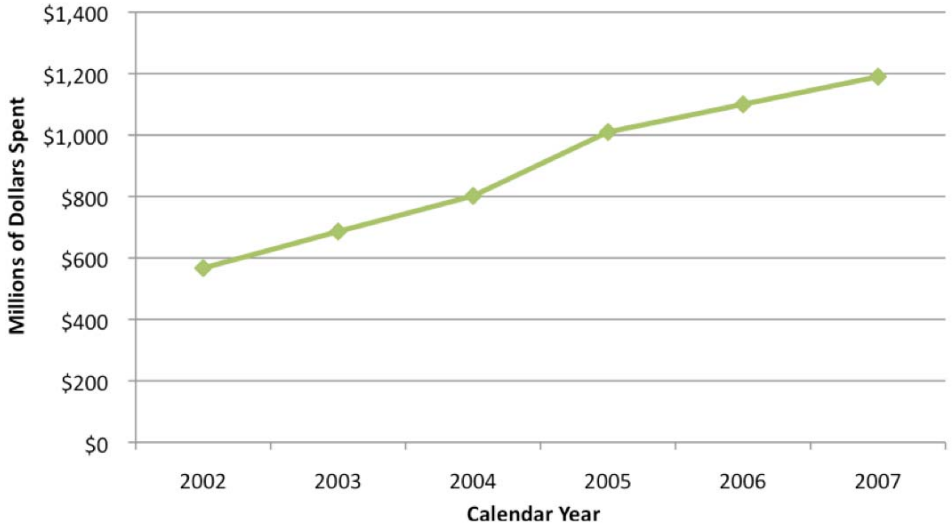


**Figure 2-2. Total Annual Spending for the Purchase of Petroleum in Vermont [4]**

**Petroleum sales multiplied by average cost per gallon.*

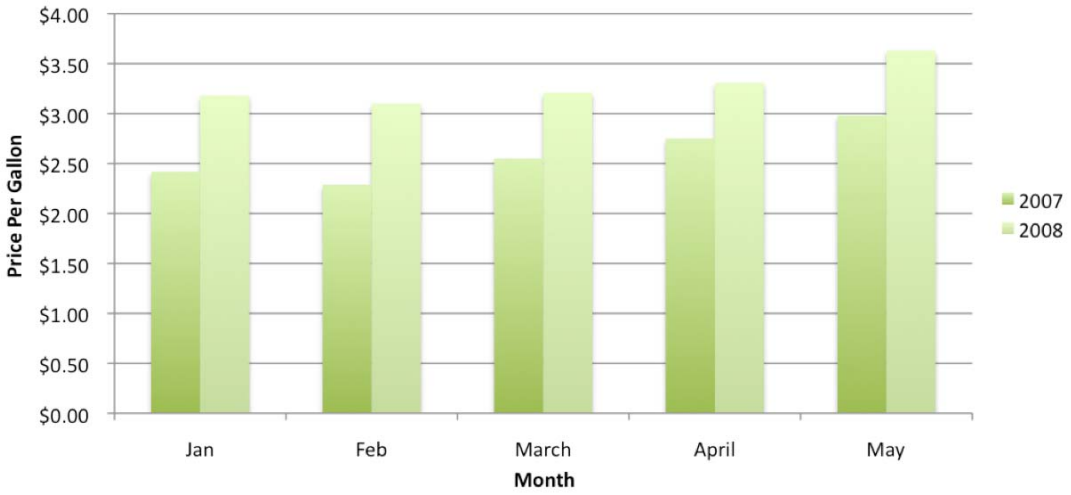


**Figure 2-3. Price per Gallon of Gasoline in Vermont January through May 2007 and 2008[4]**

As shown in Tables 2-2 and 2-3 petroleum prices in Vermont have been approximately the national average for gasoline, but slightly more than the national average for diesel.

**Table 2-2. Average Annual Costs for the Purchase of Petroleum in Vermont [5]**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Gasoline Price/Gallon | $1.36 | $1.59 | $1.88 | $2.31 | $2.59 | $2.81 |
| Diesel Price/Gallon | $1.45 | $1.71 | $1.97 | $2.58 | $2.86 | $3.02 |

**Table 2-3. Average Annual Costs for the Purchase of Petroleum in the U.S. [5]**

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|
| Gasoline Price/Gallon | $1.39 | $1.60 | $1.90 | $2.31 | $2.62 | $2.84 |
| Diesel Price/Gallon | $1.32 | $1.51 | $1.81 | $2.40 | $2.71 | $2.89 |

Rising transportation energy costs are not isolated but rather directly associated with other increasing costs which are affecting Vermonters. Figure 2-4 illustrates the trend in the cost of home heating fuels. Although the price per gallon of home heating oil remained relatively flat for much of 2007, Vermonters saw a 31.59 percent increase in fuel oil prices from January 2007 to January 2008. The percent of increase for the price of gasoline was nearly identical at 31.62 percent. The Regulatory Assistance Project estimated that Vermonters will pay about $800 million to import fossil fuels for use in our homes, businesses, and other buildings in 2008. That is an increase of at least $300 million compared to 2004 numbers, which averages to approximately $500 more per person per year.[6]

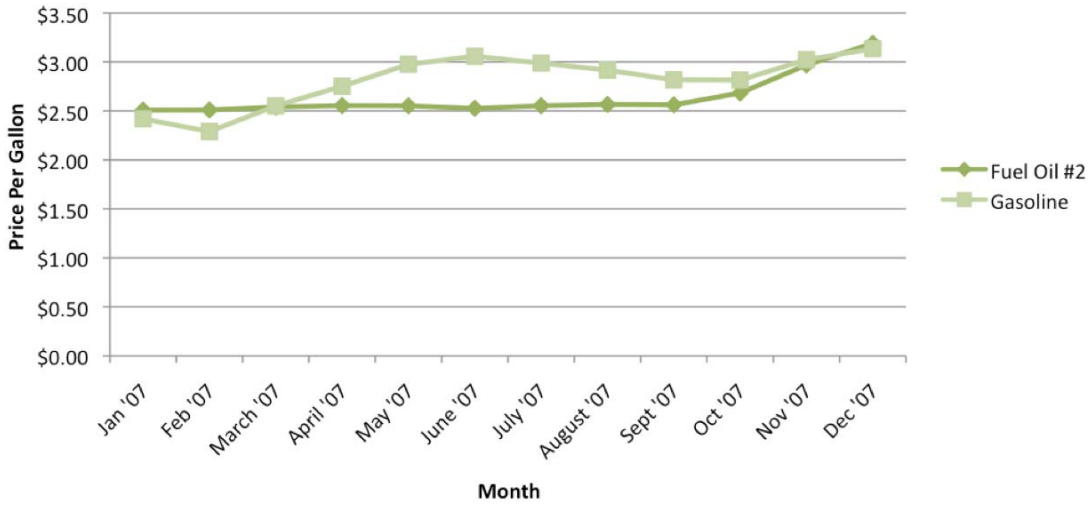


**Figure 2-4. Average Costs for Gasoline and Home Heating Fuel (Oil # 2) in Vermont in 2007 by month[7]**

# 3. Vehicles, Travel and Emissions

## 3.1. Vehicle Fleet

The Clean Cities mission to reduce reliance on fossil fuels is directly related to the vehicle fleet composition. Tracking changes in the fuel efficiency of the vehicle fleet and the number of vehicles powered by non-petroleum based fuels is therefore an important indicator of fuel consumption trends. Vehicle fleets turn over on average every 9 years and thus changes in vehicle fleets must be looked at within that time horizon.[8]

Because raw data are not readily available from public sources, the UVM Transportation Research Center contracted with R.L. Polk & Co., an international automotive research and marketing firm, to provide Vermont specific data related to automobile purchases. These data provide the TRC with a unique data set that can be used to better understand trends and directions in Vermont's fleet composition.

Vehicle registrations, like the state's population, increased from 2004 to 2006. However, in 2007 vehicle registrations dipped (see Table 3-1). From 2004 to 2006 the number of vehicles registered rose by nearly 7,000. In 2007, registrations decreased by approximately 800. The number of driver licenses in effect took a major downturn from 2005 to 2006 falling by just over 29,000, but then rose again in 2007 by about 6,000. These trends suggest that although more Vermonters possess a driver's license they do not necessarily have increasing access to vehicles. Access to a vehicle does affect levels of household trip making.

**Table 3-1.Vehicle Registrations and Drivers Licenses in Vermont by Calendar Year**[9]

| | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| **Vehicle Registrations*** | 568,309 | 573,470 | 575,163 | 574,370 |
| **Driver Licenses** | 556,821 | 561,338 | 532,041 | 538,372 |
| **Vermont Population** | 618,794 | 619,736 | 620,778 | 621,254 |
| **Vehicles per licensed driver** | 1.02 | 1.02 | 1.08 | 1.08 |
| **Vehicle per capita** | .92 | .92 | .93 | .93 |

***Registrations include state vehicles, municipal vehicles, trucks, and autos. Does not include buses, agricultural vehicles dealers, handicap placards, motorcycles, or trailers.*

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The number of new vehicle purchases as shown in Figure 3-1 has continued to decrease from 2004 to 2007. Just over 37,000 new vehicles were purchased in 2007 in Vermont. This is a decrease from previous years of about 5,000, or a 12.4 percent decrease, from 2004 to 2007.

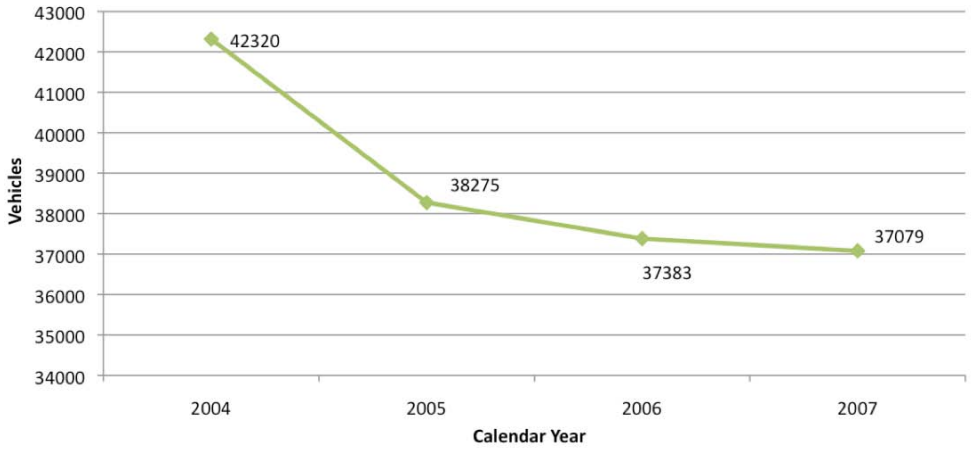


**Figure 3-1 Number of New Vehicle Purchases in Vermont by Calendar Year**

As shown in Table 3-2 most of these new vehicle purchases were gasoline-powered vehicles (91 percent). Approximately 2 percent were diesel. Of note, more than 1,190 vehicles which can be run on either ethanol or gasoline ("flex fuel") were purchased in the state, although ethanol is not commercially available for fueling vehicles in Vermont.

**Table 3-2. New Vehicle Purchases in Vermont by Fuel Type**

| Fuel | 2006 Number Sold (new) | 2006 Percent of Total Sold | 2007 Number Sold (new) | 2007 Percent of Total Sold |
|---|---|---|---|---|
| Gasoline | 33,547 | 94% | 33,913 | 91% |
| Diesel | 886 | 2% | 717 | 2% |
| Flex fuel (ethanol/gasoline) | 939 | 3% | 1,190 | 3% |
| Hybrid | 420 | 1% | 1,255 | 3% |
| Electric | 5 | <1% | 1 | <1% |
| Natural Gas | 1 | <1% | 2 | <1% |
| **Total** | **35,798** | | **37,079** | |

There was an 8 percent increase in gasoline powered vehicle registrations from 2006 to 2007. More than 1,255 hybrids sold in Vermont in 2007 and 3,651 registered in the state. As shown in Table 3-3 this represents a 55 percent increase in hybrid registrations from 2006 to 2007. At the same time pure electric vehicles and propane powered vehicles registered in the state decreased between 2005 and 2007 by 10 and 27 percent respectively.

**Table 3-3. Vehicles Registered in Vermont by Fuel Type**[9]

| Fuel | 2005 | 2006 | 2007 | Change 2005-2007 |
|---|---|---|---|---|
| Hybrids | 1,510 | 2,358 | 3,651 | +142% |
| Electric | 118 | 110 | 106 | -10% |
| Propane | 127 | 110 | 93 | -27 % |
| Diesel | 27,504 | 29,161 | 31,648 | +15% |
| Gasoline | 543,009 | 542,126 | 583,568 | +7% |
| Total | 572,268 | 573,865 | 619,066 | +8% |

## 3.2 Fuel Economy

Fuel economy is one of two direct links to fuel consumption and thus expenditures. (The other direct link is the total distance or miles traveled which is discussed in section 3.3.) A vehicle fleet with high fuel economy is less reliant on fossil fuels, which is the Clean Cities mission. Table 3-4 illustrates that 15 percent of new vehicle purchases in Vermont in 2007 had a combined average fuel economy of 33 miles per gallon (mpg). Thirty-three percent had a combined average fuel economy of less than 20 mpg and 30 percent had a combined average fuel economy of just over 20 mpg. (These numbers are based on the EPA's fuel economy rating of each vehicle make purchased within each of these segments in 2007. The percentages do not add up to 100 because only the national top five of 27 selling segments are listed in the Table.)

The Top Five Segments were the only segments to sell over 10,000 new vehicles from 2004-2007. (Avg. fuel economy of segment was calculated using the EPA estimated fuel economy for each vehicle purchased in Vermont in that segment in 2007, combining all fuel economy ratings within each segment, and dividing by the total number of vehicles within a segment to find the average.)

**Table 3-4. New Vehicle Purchases in Vermont in 2007 by Top Five Selling Segments**

| Segment | Avg. Fuel Economy[12] | Range of Fuel Economy in Segment (Lowest - Highest) | Total Sold in VT by Segment | Total New Car Sales in VT |
|---|---|---|---|---|
| Basic Economy | 33 mpg | VW Rabbit (22) – Toyota Prius (46) | 5,560 | 15% |
| Full-size Pickup | 19 mpg | Chevy Avalanche (14) – GMC Sierra (17) | 6,970 | 19% |
| Mini Sport Utility | 21mpg | Land Rover LR2 (15) – Ford Escape Hybrid (27) | 4,665 | 16% |
| Sport Utility | 18 mpg | Infiniti QX56 (14) – Toyota Highland Hybrid (26) | 5,231 | 14% |
| Upper Middle | 23 mpg | Ford Five Hundred (19) – Honda Accord Hybrid (27) | 5,061 | 14% |

Of the top five selling segments in Vermont, Basic Economy is the most fuel efficient while Full-size Pickup and Sport Utility are the least fuel efficient. Although actual averages have differed slightly from year to year, the basic trend in fuel economy of the Vermont fleet has essentially remained the same between 2004 and 2007. Note in Table 3-5 that, although from 2004 to 2007 new purchases of the Full-size Pickup and Sport Utility lines have decreased by 15 and 17 percent, the purchase of new Mini Sport Utility vehicles increased by 20 percent.

**Table 3-5. New Vehicle Purchases 2004 – 2007 by Top Five Selling Segments in Vermont**

| Segment | 2004 | 2005 | 2006 | 2007 | Change 2004-07 |
|---|---|---|---|---|---|
| Basic Economy | 5514 | 5437 | 5444 | 5560 | <1% |
| Full-size Pickup | 8204 | 7335 | 6572 | 6970 | -15% |
| Mini Sport Utility | 3903 | 3937 | 4634 | 4665 | +20% |
| Sport Utility | 6329 | 5704 | 4937 | 5231 | -17% |
| Upper Middle | 5864 | 5191 | 5327 | 5061 | -14% |

Dealerships typically have available each Model Year (MY) from its release in the fall or winter of the previous Calendar Year (CY) until the end of the MY. For example in 2007, new MY 2007 vehicles were available most of the CY, and MY 2008 vehicles became available in the last quarter of the CY. Also, MY vehicles tend to sell out by the end of their CY, such that there were probably no MY 2006 vehicles sold from dealerships in CY 2007.

The top four most fuel efficient vehicles of MY 2007 were hybrids. The fifth most fuel efficient vehicle was the non-hybrid Toyota Yaris. Of the 11 most efficient, 9 were cars and 2 were hybrid SUVs. The top four most fuel efficient vehicles of MY 2008 were hybrids. Of the 11 most efficient, 8 were cars and 3 were hybrid

SUVs. Purchases of all of these top-ranked fuel-efficient new vehicles available for sale in 2007 (i.e. MY 2007 and 2008) comprised 9.9 percent of the total new vehicle sales in Vermont in 2007.

As gasoline prices continue to rise (see section 2) Vermont hybrid sales have also continued to increase. As shown in Table 3-6, between 2004 and 2005 Toyota Prius sales (the nation's top selling hybrid) doubled in Vermont, and doubled again between 2005 and 2007. The percent of new hybrid vehicles purchased in Vermont in relation to all new vehicles purchased has increased to more than 3 percent in 2007, compared to less than 1 percent in 2004.

**Table 3-6. New Hybrid Electric Vehicle (HEV) Purchases in Vermont by Model**

| Model | 2004 | 2005 | 2006 | 2007 | Total Sold Over 4 Years |
|---|---|---|---|---|---|
| Accord | 2 | 34 | 13 | 6 | 55 |
| Altima | -- | -- | -- | 16 | 16 |
| Aura | -- | -- | -- | 4 | 4 |
| Camry | -- | -- | 70 | 123 | 193 |
| Civic | 112 | 96 | 91 | 111 | 410 |
| Escape | 17 | 70 | 44 | 30 | 161 |
| GS | -- | -- | -- | 1 | 1 |
| Highlander | -- | 78 | 160 | 97 | 335 |
| Insight | 4 | 3 | 5 | -- | 12 |
| Mariner | -- | 1 | 6 | 12 | 19 |
| Prius | 197 | 405 | 503 | 815 | 1920 |
| RX300/RX330/RX400h | -- | 18 | 13 | 21 | 52 |
| Vue | -- | -- | 1 | 19 | 20 |
| **Grand Total** | 332 | 705 | 906 | 1255 | 3198 |

Fueleconomy.gov ranks vehicles by models year from most efficient to lease efficient based on their EPA rated miles per gallon. As shown in Table 3-7 new vehicle purchases of models that ranked in the top 10 most efficient based on their EPA rated average miles per gallon for MY 2008 made up 10.5 percent of the total new vehicle purchased in Vermont in 2007. There were a total of 37,079 new vehicles purchased in Vermont in 2007.

**Table 3-7. Top 10 Most Gasoline Fuel Efficient Cars MY 2008**[10]

| Vehicle | City/Hwy MPG* | Type | # of New Vehicles Sold in VT (2007) |
|---|---|---|---|
| Toyota Prius | 48/45 | Car | 815 |
| Honda Civic Hybrid | 40/45 | Car | 111 |
| Nissan Altima Hybrid | 35/33 | Car | 16 |
| Smart for Two Convertible/Coup | 33/41 | Car | 0 |
| Toyota Camry Hybrid | 33/34 | Car | 123 |
| Toyota Yaris | 29/36 | Car | 225 |
| Toyota Corolla | 28/37 | Car | 1185 |
| Mini Cooper/Clubman | 28/37 | Car | 70 |
| Honda Fit | 28/34 | Car | 201 |
| Honda Civic | 26/34 | Car | 760 |

As shown in Table 3-8, vehicles with some of the worst EPA rated gasoline mileage made up just over 1 percent of the new vehicle purchases (37,079 purchased) in 2007 in Vermont.

**Table 3-8. Top 10 Most Gasoline Fuel Inefficient Cars MY 2008**[10]

| Vehicle | City/Hwy MPG* | Type | # of New Vehicles Sold in VT 2007 |
|---|---|---|---|
| Bugatti Veyron | 8/13 | Car | 0 |
| Lamborghini Murcielago / | 8/13 | Car | 0 |
| Bentley Azure | 9/15 | Car | 0 |
| Bentley Arnage | 9/15 | Car | 2 |
| Mercedes-Benz G55 AMG | 11/13 | SUV | 2 |
| Hummer H2 | 12/16 | SUV | 68 |
| GMC Yukon 2500 | 12/16 | SUV | 52 |
| Jeep Grand Cherokee | 17/22 | SUV | 298 |
| Mercedes-Benz GL320 CDI | 18/24 | Car | 12 |
| Mercedes-Benz R320 CDI | 18/24 | SUV | 12 |

In addition to reducing fuel use, owning a vehicle in the basic economy segment could save drivers a significant amount of money each year. In Vermont the average highway vehicle miles traveled (VMT) per capita per year is approximately 12,400.[15] Consequently, the owner of a basic economy vehicle in Vermont that gets on average 33 mpg pays $1,503 per year for gasoline; while the owner of a sport utility vehicle in Vermont with an average mpg of 18 pays $2,756 per year. The national average highway VMT per capita per year is about 10,100,[15] thus because Vermonters are driving more they are in turn paying more on average (because Vermont gasoline prices are similar to the national average – see Tables 2-2 and 2-3). Nevertheless, a Vermont driver that owns a basic economy vehicle and drives the average 12,400 highway miles each year would still pay less ($1,503) than the average American driver that owns a sport utility vehicle and drives the average 10,100 highway miles per year ($2,244). (All numbers assume the cost of gasoline equals $4/gallon).[11]

## 3.3. Travel - Vehicle Miles Traveled (VMT) in Vermont

Vehicle miles traveled (VMT) are key data for highway planning and management, and a common measure of roadway use. Along with other data, the VMT measure is 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 [12].

VMT is one of the two factors for vehicle petroleum use (the other being vehicle fuel economy discussed in section 2.2). As Table 3-9 shows, vehicle miles traveled per person declined between 2004 and 2007. Of note, however, is that these numbers are estimates. These numbers are derived from both permanent and rotating automatic counters on roadways thus VMT is an estimate whose accuracy varies depending on the location of the rotating counters. Counters are unable to distinguish between residents and non-residents or visitors. Reducing VMT would clearly reduce use of petroleum. Options that would reduce

VMT in a rural state include rideshare programs such as ride matching and vanpools, targeted bike-ped programs and infrastructure development, including sidewalks and bike lanes and finally targeted transit.

**Table 3-9. Vermont Average Annual VMT by Calendar Year (In Millions)** [13]

| | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| **Vermont** | 7,717.2 | 7,611.3 | 7,688.4 | 7,528.6 |
| **U.S.** | 2,930,238 | 2,971,785 | 3,004,246 | 3,009,492 |

As Table 3-10 shows, commuters in Vermont in 2000 were on par with the national average for driving alone, car pooling, and using motorcycles, bicycles or other means, but were below the national average in use of public transportation. Vermont had a higher than national average number of workers who worked at home and who walked to work. [14]

The Census Journey to Work data were last collected in 2000. In 2008 the Vermont Agency of Transportation, Chittenden County Metropolitan Planning Organization and the UVM TRC are jointly sponsoring an "add-on" survey of 1500 Vermont households with the National Household Transportation Survey. This will provide us with more updated data in Table 3-10 next year.

**Table 3-10. Journey to Work (2000)** [14]

| | Drove alone | Carpooled | Public transportation | Walked | Motorcycle, bike, other means | Worked at home |
|---|---|---|---|---|---|---|
| **Vermont** | 75.2% | 11.9 % | 0.7 % | 5.6 % | 0.9 % | 5.7 % |
| **National** | 75.7 % | 12.2 % | 4.7 % | 2.9 % | 1.2 % | 3.3 % |

No accurate data exist for the miles of travel by non-motorized means. This is a national problem that is not unique to Vermont. VTrans has had two bicycle/pedestrian counters for two years. One has remained in place on a sidewalk on Main Street in downtown Montpelier. The other rotates through Regional Planning Commissions. The CCMPO also has pedestrian counters. The UVM Transportation Research Center has the data from the Montpelier counter, which is summarized in Figures 3-2 through 3-6 below. The graphs show a consistent distribution of pedestrians throughout the day regardless of season. This is attributable to Montpelier's character as community of day workers who arrive and leave the city by means other than walking but who access services by foot during the noon time. Overall pedestrian volume is high and collection of more data will be important for policy and planning effor

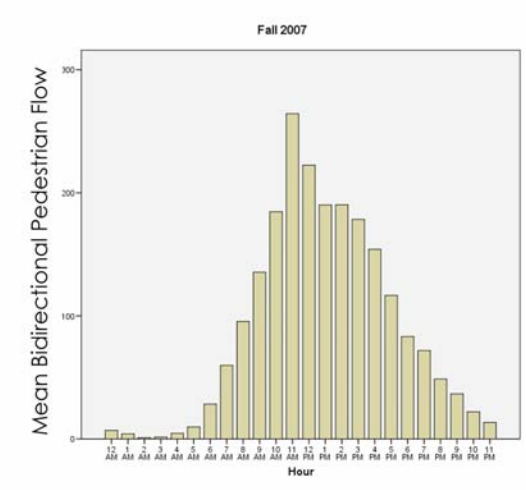


**Figure 3-2. Fall 2007 Pedestrian Counts, Montpelier, Vermont**

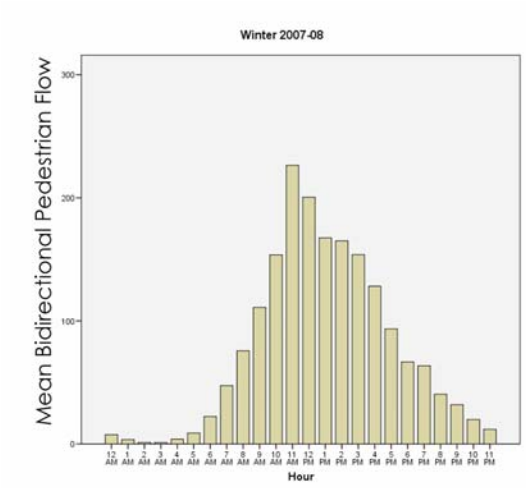


**Figure 3-3. Spring 2007 Pedestrian Counts, Montpelier, Vermont**

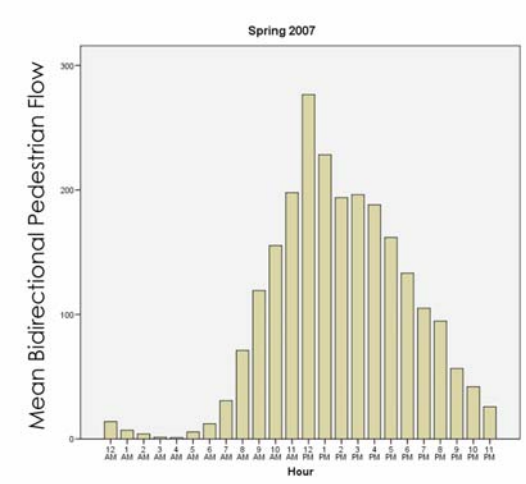


**Figure 3-4. Summer 2007 Pedestrian Counts, Montpelier, Vermont**

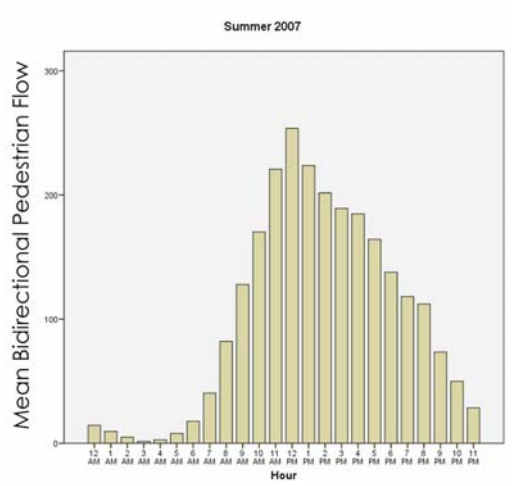


**Figure 3-5. Winter 2007 Pedestrian Counts, Montpelier, Vermont**

## 3.4. Vehicle Tailpipe Emissions Data

Approximately 20 lbs of $CO_2$ is produced for every gallon of gasoline consumed (Vermont Agency of Natural Resources, Air Pollution Division). Figure 3-6 illustrates that as a percentage the transportation sector is a large portion (44 percent) of Vermont's $CO_2$ emissions. In the United States, transportation accounts for 26 percent of the national carbon emissions. As a result of Vermont being a predominantly rural state, the combination of land use and development patterns and limited public transit result in long distances traveled by single occupant vehicles. Thus, transportation emissions are higher than the national average. Note that this percentage is slightly misleading. Whereas electricity makes up a large portion of total U.S. emissions, Vermont's grid is powered in large part by nuclear and hydro – arguably carbon-neutral energy sources. Electricity accounts for only 5 percent of Vermont's emissions compared to the U.S.'s 32 percent. Therefore, on an absolute ton per person

basis transportation emissions of carbon are only slightly higher than national averages (based on VMT). However, in terms of policy focus for reducing greenhouse gasoline emissions the large percentage for transportation makes it an important focus within the state.

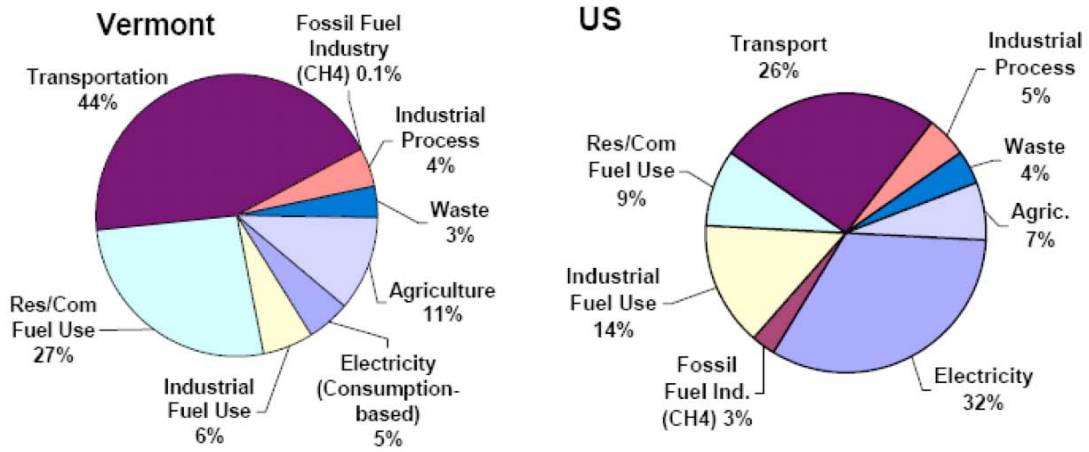


**Figure 3-6. Average U.S. and Vermont Emissions Data by Sector** [15]

*Copied directly from Governor's Commission on Climate Change: Inventory and Forecast, http://www.vtclimatechange.us/ewebeditpro/items/0123F1187.pdf (Retrieved June 2007)*

# 4. Programs that Impact Transportation Fuel Use

## 4.1. State Spending on Transportation

Table 4-1 outlines Vermont's transportation budget by program for four fiscal years while Table 4-2 outlines actual expenditures in the same categories. The State of Vermont's overall transportation budget increased between 2004 and 2007. Certain increases within that budget promote strategies and physical infrastructures that reduce petroleum dependence and reliance on single occupancy vehicles (SOV). Collectively these budget items are referred to as 'alternatives'. The tables below include selected traditional transportation spending items for comparison and line items for categories that may reduce reliance on SOV (shown in the shaded rows). The amount of money appropriated (Table 3-1) for public transit has remained relatively constant, as has the actual amount expended (Table 3-2) on public transit. Money appropriated and expended for pedestrian and bicycle facilities as well as park and ride facilities has also remained generally constant. Rail appropriations and expenditures dipped in 2005 and 2006 and then increased in 2007. Spending as a percentage of the overall Vermont Agency of Transportation budget for alternatives decreased from fiscal years 2004 to 2005 and then increased slightly in 2006, but decreased again in 2007. Expenditures on alternatives as shown in Table 4-2 lagged behind the appropriated amount, shown in Table 4-1, in 2005, 2006 and 2007.

**Table 4-1. Total Appropriated by Fiscal Year [16]**

| Budget line items* | FY 2004 | FY2005 | FY2006 | FY2007 |
|---|---|---|---|---|
| Paving & maintenance | 24 % | 23 % | 27 % | 25 % |
| Roadway | 18 % | 21 % | 15 % | 16 % |
| Bridges (incl. maintenance) | 9 % | 8 % | 9 % | 9 % |
| Town Programs | 16 % | 15 % | 16 % | 15 % |
| Finance, Planning, DMV | 10 % | 10 % | 11 % | 9 % |
| **Public transit** | 3 % | 4 % | 4 % | 4 % |
| **Bike and Pedestrian** | 2 % | 1 % | 1 % | 1 % |
| **Park & ride** | <1 % | <1 % | 1 % | <1 % |
| **Multi-modal** | <1 % | <1 % | <1 % | <1 % |
| **Rail** | 4 % | 3 % | 3 % | 5 % |
| Total transportation budget in Millions of Dollars | $354 | $368 | $354 | $454 |
| **Percent for alternatives** | **9.9 %** | **8.2 %** | **8.6 %** | **11 %** |

**Items in bold within the table are considered line items for alternatives to the SOV.*

**Table 4-2. Total Expended by Fiscal year [16]**

| Budget line items* | FY 2004 | FY2005 | FY2006 | FY2007 |
|---|---|---|---|---|
| Paving & maintenance | 28 % | 27 % | 28 % | 29 % |
| Roadway | 13 % | 16 % | 15 % | 14 % |
| Bridges (incl. maintenance) | 6 % | 10 % | 8 % | 9 % |
| Town Programs | 16 % | 16 % | 15 % | 17 % |
| Finance, Planning, DMV | 12 % | 11 % | 11 % | 12 % |
| **Public transit** | 4 % | 4 % | 4 % | 4 % |
| **Pedestrian & bike** | 2 % | 1 % | 1 % | 1 % |
| **Park & ride** | <1 % | <1 % | <1 % | <1 % |
| **Multi-modal** | <1 % | <1 % | <1 % | <1 % |
| **Rail** | 3 % | 2 % | 2 % | 3 % |
| Total transportation expenditures in Millions | $300 | $328 | $338 | $388 |
| **% for alternatives** | **9.9 %** | **7.4 %** | **8.3 %** | **8.1 %** |

**Items in bold within the table are considered line items for alternatives to the SOV.*

## 4.2. Transit Ridership

Increased transit ridership can result in reduced petroleum use, especially if the transit mode is heavily used or at full capacity. Figure 4-1 shows the passenger miles per gallon of fuel by mode based on the actual passenger numbers reported to the National Transit Database in 2005[17]. These numbers reflect actual usage and not potential usage for each non-SOV mode.

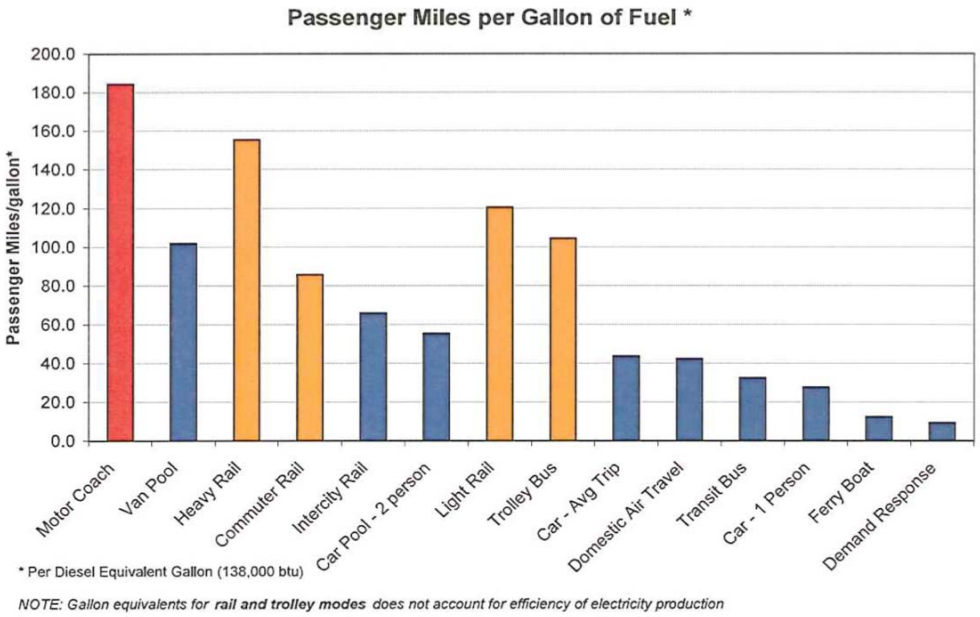


**Figure 4-1 Passenger Miles per Gallon of Fuel by Mode** [18]

Tables 4-3 and 4-4 illustrate data from two of Vermont's major transit companies as well as Amtrak's Vermont rail services. The Chittenden County Transit Authority (CCTA) operates 20 different fixed route services. GMTA operates 20 fixed service routes in Washington and Lamoille counties. There are 11 other transit operators in Vermont from which data were not gathered. Amtrak offers the Vermonter service between Washington D.C. and St. Albans, Vermont as well as the Ethan Allen Express service between New York City and Rutland, Vermont. These daily services stop at 11 stations in Vermont and one train runs in each direction daily on each of these routes. Table 4-4 contains a sum of passenger use at all Vermont stations. The data in Tables 4-3 and 4-4 indicate public transit ridership has increased substantially between 2004 and 2007.

**Table 4-3. Bus Ridership in Fiscal Years (FY) 2004–07 for Two Vermont Transit Providers [19]**

| Transit Provider | FY04 | FY05 | FY 06 | FY07 | Change 2004-07 |
|---|---|---|---|---|---|
| CCTA | 1,799,699 | 1,887,104 | 2,009,371 | 2,120,751 | +18% |
| GMTA | 176,935 | 228,490 | 237,287 | 243,244 | +37% |

**Table 4-4. Total Vermont Amtrak Station Usage [20]**

| FY 04 | FY05 | FY06 | FY07 | Change 2004-07 |
|---|---|---|---|---|
| 59,860 | 57,121 | 64,647 | 72,822 | +22% |

## 4.3. Alternative Fuel Vehicles

As indicated in Table 4-5, in 2007 there were a total of 4,313 known alternative fuel vehicles in the state. Data for all fuel categories except for hybrid electric vehicles (HEVs) were obtained via phone survey of fleets by Vermont Clean Cities Coalition at the UVM Transportation Center in February of 2008. The survey may not have covered all fleets or vehicle owners. Data for HEVs were obtained from the Vermont Department of Motor Vehicles. The data for biodiesel have an unknown, but probably significant, margin of error, due to the fact that any diesel vehicle can use biodiesel without any authorities being aware of it. Vehicles that run on recycled vegetable oil (also known as 'grease') are not characterized below because it is not a reported fuel type, a significant amount is made by non-commercial operations for use by private vehicle owners. Therefore Table 4-5 is intended only to provide a general idea of how many alternative fuel vehicles exist in the state.

**Table 4-5. Alternative Fuel Vehicles (AFV) in Vermont**

| Fuel type | Vehicle type | 2006 Number in the state | 2007 Number in the state |
|---|---|---|---|
| B100 (100 percent Biodiesel) | Light-Duty | 0 | 0 |
| B20 (20 percent Biodiesel) | Light-Duty | 38 | 39 |
| B20 (20 percent Biodiesel) | Heavy-Duty | 101 | 370 |
| Electricity | Light-Duty | 4 | 106 |
| LPG (Liquefied Petroleum Gas) | Light-Duty | 13 | 2 |
| NEV (Neighborhood Electric Vehicle) | Light-Duty | 9 | 39 |
| LPG (Liquefied Petroleum Gas) | Heavy-Duty | 107 | 91 |
| CNG (Compressed Natural Gas) | Light-Duty | 8 | 8 |
| CNG (Compressed Natural Gas) | Heavy-Duty | 6 | 3 |
| Plug-in Hybrid | Light-Duty | 1 | 3 |
| H2 (Hydrogen) | Light-Duty | 1 | 1 |
| HEV (Hybrid Electric Vehicle)[21] | Light-Duty | 2,389 | 3,651 |
| **Total** | | **2,677** | **4,313** |

Based on these numbers, heavy-duty B20 vehicles have more than tripled in the state, HEVs numbers have increased by over a thousand, and electric vehicles went from 4 in 2006 to 106 in 2007. It is important to note, however, that this increase may be due to the increase in survey size and, presumably, accuracy.

## 4.4. Transportation Demand Management

*Transportation Demand Management* or *TDM* refers to various strategies that change travel behavior (how, when and where people travel) in order to increase transport system efficiency and achieve specific planning objectives. [22]

"The concept of TDM has its origins in the 1970s and 1980s, as a result of the hard economic impacts resulting from the sharp increase of the crude oil prices during the 1973 oil crisis and the 1979 energy crisis. As long lines appeared at gasoline stations in the United States, it became self-evident the need to provide for alternatives to single occupancy commuter travel in order to save energy, improve air quality, and reduce peak period congestion, thus reducing travel costs and lost time." [23]

Today these goals remain the same, and they are now part of the effort to reduce greenhouse gasoline emissions from urban transportation, but the range of measures "has broadened to encompass the desire to optimize transportation system performance for commute and non-commute trips and for recurring as well as non-recurring events". [23]

Way to Go! is an annual weeklong program in May that markets alternatives to the SOV to Vermont commuters and schoolchildren. It is organized by the CCMPO, VTrans, CATMA, CCTA, the Lake

Champlain Committee, Local Motion, Vermont RideShare and the 10 percent Challenge. Participation is voluntary and focused in Chittenden County; results are self-reported by registrants, and not verified. There has been a steady increase in program participation between 2005 and 2008. Registrants (Table 4-6) report information regarding their regular commute as well as their intended alternative commute during the week of Way to Go!. Based on differences between pledged and usual trip characteristics, fuel savings are calculated and communicated to the registrant. The total gasoline gallons saved varies depending on the alternative modes participants pledge to use. Totals for the estimates are listed in the second row of Table 4-6.

**Table 4-6. Way to Go Results**

| | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| **Number of registrants** | 628 | 1,175 | 1,880 | 2,738 |
| **Total gasoline gallons saved** | 2,437 | 3,780 | 12,385 | 9,640 |

Safe Routes to School is a federal program aimed at increasing the number of children who walk or bicycle to school. Safe Routes to School funds projects that remove the barriers that currently keep children and their parents from walking or biking to school. "Barriers include lack of infrastructure, unsafe infrastructure, and lack of programs that promote walking and bicycling through education/encouragement programs aimed at children, parents, and the community." [24]

Providing options for children to get safely to school is another means of reducing VMT and improving public health. The number of schools participating in Vermont's Safe Routes to Schools Program is now at 30 (as indicated in Table 4-7), an increase of 2 from the 2006-2007 numbers. The federal program, administered by VTrans, that encourages schoolchildren to walk and bike to school on a regular basis awarded a total of $268,290 to participating schools in Vermont this year.

**Table 4-7. Schools Participating in Safe Routes to Schools Programs by Region[25]]**

| Region | # of Schools |
|---|---|
| Bennington County Regional Commission | 1 |
| Chittenden County Metropolitan Planning Organization | 12 |
| Central Vermont Region Planning Commission | 4 |
| Rutland Regional Planning Commission | 7 |
| Two Rivers Ottauquechee Regional Commission | 1 |
| Windham Regional Commission | 5 |
| **Total # of Schools Participating** | **30** |

Reducing vehicle idling is another means of reducing fossil fuel use. Idling is defined as leaving your vehicle turned on when you are not in motion for more than 10 seconds. The impacts to vehicle owner of idling include, decreased fuel efficiency, and increased engine wear. Developing a strong anti-idling public information campaign would assist in debunking several myths around vehicle idling. Many groups have an interest in establishing formal anti-idling efforts. Most of these groups are among the Clean Cities stakeholders.

Anecdotal evidence shows that with each year more individuals are beginning to look for alternatives to the single-occupancy vehicle (SOV), but in order to really understand the changes in transportation

energy use more empirical research must be done. For example stories of park and ride lots in the state reaching capacity are commonplace; however, official state counts are only taken once a year in November. The data that are collected in November each year do support the suggestion that people are in search of alternatives as many of these lots have neared or gone above full capacity for the past 2 years. In fact, lots in the towns of Randolph and Weathersfield have gone well above capacity. In 2006 the Randolph lot was at 140 percent capacity and in 2007 it was at 133 percent capacity. In 2006 the Weathersfield lot was at 102 percent capacity and in 2007 it rose to 120 percent capacity.

The strong interest in the formation of another Transportation Management Association (TMA) in downtown Burlington on top of the two that already exist in Vermont suggests that changes in travel behavior and thus transportation energy use are on the horizon. CATMA is already providing shuttles for over 2 million riders a year linking them to CCTA bus routes, as well as providing incentives for people to carpool, bike, walk, and telecommute. In a 2005 study found that in CY 2004 Advance Transit reduced VMT by over 844,500 miles and reduced air pollutants by 3 ½ tons.[26] While these numbers do not provide concrete evidence of a change in energy use in the transportation sector, they suggest mechanisms in place that may be behind the data showing VMT and fuel use remaining constant in recent years.

# 5. Conclusions

As the price of transportation and home heating fuels increase, Clean Cities' goal of reducing our society's reliance on fossil fuels becomes more pertinent. Clean Cities Coalitions promote diversity in the transportation system including the use of alternative fuels, modes, and programs such as anti-idling campaigns that cut down on petroleum use. It has become apparent in Vermont and around the nation that fuel prices are having an impact on peoples' lives. Although limited, there has been increasing evidence that travel behavior is changing – increased transit ridership, flat to declining VMT and changes in purchases. Now more than ever it is evident that relying on one source of energy to move ourselves and our goods is no longer feasible – Clean Cities Coalitions exist to drive that point home, but more importantly to help move the transportation sector into a future far less dependent on fossil fuels.

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