

# Vermont in Transition:

*A Summary of Social Economic and Environmental Trends*

A study by

**Center for Social Science Research at Saint Michael's College**

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for the

**Council on the Future of Vermont**

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## Chapter 10: ENERGY



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# Chapter 10: ENERGY

The year 2008 will be remembered in Vermont as a year of volatility in financial and energy markets. Oil prices reached record highs before plummeting to rates not seen in years. Today's unpredictable and precarious energy markets are a stark reminder of how fundamental energy is to a well functioning modern society and the economy. The way energy is used, where and how it is produced, its cost and its environmental impact are foremost on the minds of Vermonters. We use energy to heat, cool and light our homes, power our ever-increasing range of appliances, transport people and goods, manufacture our products, produce our food and clean our water. About one-half of the state's total energy use is based on petroleum related fuels that are imported from other states and countries, and approximately another 40% is in the form of electricity, which comes largely from low emission sources. Vermont is fortunate in that its current electricity portfolio produces very low amounts of greenhouse gases that contribute to global warming.<sup>1</sup>

Until recently, demand for energy in Vermont has been increasing, driven largely by the pressures from population growth, economic development, and vehicle travel. Overall, energy demand grew by 25% between 1990 and 2005. The two largest contributors to this growth were petroleum-based fuels, which grew by 33% (primarily for transportation and heating), and electricity, which grew by 20%. Since 1990, the per capita demand for energy in Vermont has shown steady growth, and energy demand has increased in each end-use sector of the economy (transportation, residential, commercial, and industrial) by 19% or more. Between 1990 and 2004, per capita energy demand rose roughly 13%, compared to only 4% growth elsewhere in New England and relatively flat growth nationwide. Vermont relies heavily on petroleum-based fuels in the transportation sector, and until this year, the total amount used had

risen due to more vehicle miles traveled.<sup>2</sup> However, in recent months Americans are driving less (we would expect to see the same trend in Vermont). More specifically, Americans drove 4.7% fewer miles in June of 2008 than a year earlier.<sup>3</sup>

## Trends in Vermont's Energy Use

*Trend Number 1: Vermont energy use has been rising steadily over the last 45 years, at a rate greater than the nation as a whole, but the level of per capita energy use remains well below national standards.*

Vermont's energy use over the last 45 years has steadily increased. In 1960, Vermonters used 68.6 trillion Btus (British Thermal Units) of energy.<sup>4</sup> By 2005, Vermonters' energy consumption grew to 167 trillion Btus. Vermont's total energy consumption grew by 3.2% per year as compared to the US average annual increase of 2.2%.<sup>5</sup> While the data shows that the rate of energy growth in Vermont is faster than for the rest of the US, Vermont has had one of the lowest *per capita* energy consumption levels among the states. Starting at a lower level, changes in energy use can lead to faster growth rates. Energy use in Vermont has increased with rising disposable income and a trend toward more "consumerism," including larger homes.

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<sup>2</sup> Ibid.

<sup>3</sup> U.S. Department of Transportation Press Briefing, *American Driving Reaches Eighth Month of Steady Decline*, Wednesday, August 13, 2008

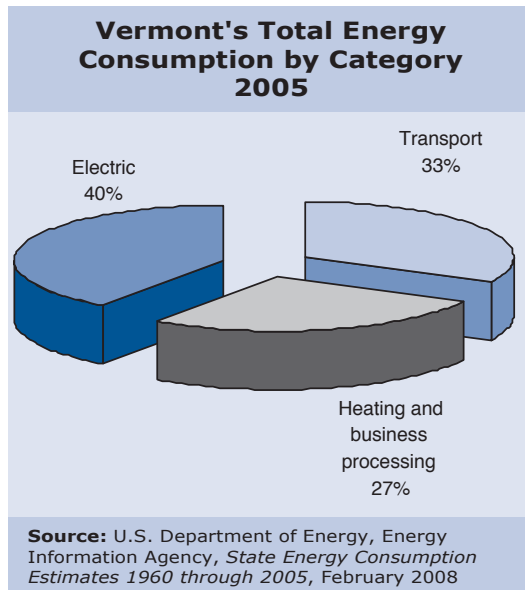
<sup>4</sup> A Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

<sup>5</sup> Department of Energy, Energy Information Agency, *State Energy Consumption Estimates 1960 through 2005*, February 2008

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<sup>1</sup> Vermont Department of Public Service, *Vermont Comprehensive Energy Plan 2009 (Draft)*, May 2008

For purposes of reporting Vermont energy trends, energy use is broken down into three broad categories; transportation, heating and business processing, and electricity. In 2005, approximately a third of Vermont's energy consumption was from transportation related activities. This sector includes vehicles used to move people and/or goods. Heating and business processes accounted for 27% of Vermont's total energy use while electricity accounted for 40% in 2005.



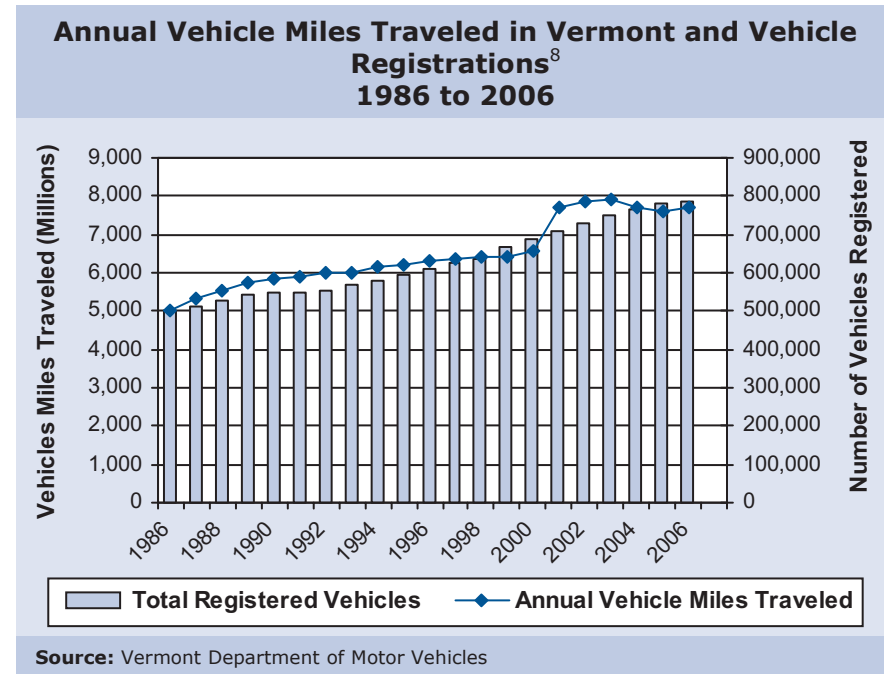
**Trend Number 2: Vermonters have been driving longer distances and registering more vehicles.**

Vermont's geography makes us dependent on private vehicles for transportation. In fact, of all energy consumed in the state, approximately 33% is for personal and commercial transportation needs. This contrasts to the United State's average of 28%.<sup>6</sup> Public transportation is limited, especially in the rural areas of the state.

Vermonters depend primarily on roads and highways to move around and transport goods. The most prevalent means of travel is by private vehicles. More than 98 percent of Vermonters ride in personal vehicles on a given day. The average daily distance driven was 36 miles in 2001, an increase of an additional 4 miles since 1995.<sup>7</sup> More than three-quarters of the vehicle miles traveled by Vermont adults were in single occupancy vehicles. This is especially true for travel to work where eighty-one

percent of commuters drive alone. The average one-way distance to work was 15 miles with more than one-half traveling less than 10 miles.<sup>8</sup>

Over the 20-year period from 1986 to 2006, the annual number of miles driven per year has increased at a rate of 1.4% per year.<sup>9</sup> Rising disposable income and changing life styles in concert with flat to declining real price for gasoline between 1986 and 2006 has led to more miles driven. At the same time, the number of vehicles registered in Vermont increased by 2.0% per year from 1986 to 2007.<sup>10,11</sup> Therefore, Vermonters are acquiring more vehicles and the number of miles traveled on roads and highways

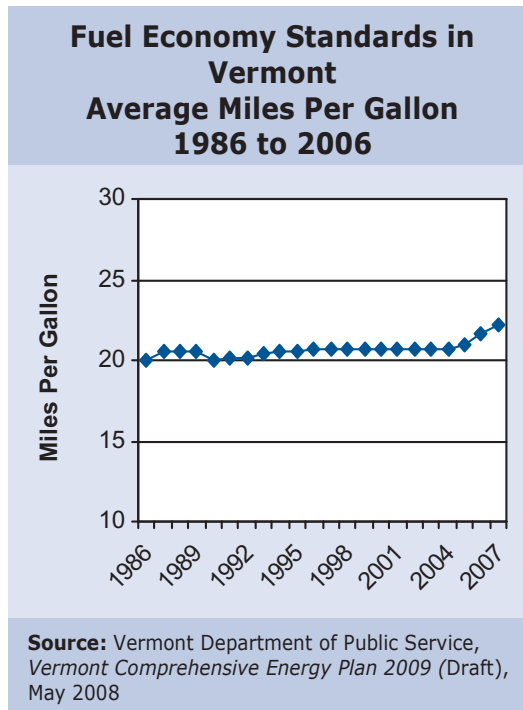


<sup>6</sup> Ibid.  
<sup>7</sup> Vermont Agency of Transportation, Vermont Long Range Transportation Plan, January 2002

<sup>8</sup> Ibid.  
<sup>9</sup> Vermont Agency of Transportation, Planning Division. Note in 2001, the estimation method changed for calculating Vehicles Miles Traveled. The large increase from 2000 to 2001 is caused by the methodology change rather than a large increase in actual miles traveled. The 1.4% average increase over the period was calculated excluding the increase from 2000 to 2001, thereby, removing the methodology change impact.  
<sup>10</sup> Vermont Department of Motor Vehicles  
<sup>11</sup> The 2% growth rate of registered vehicles is considerably faster than Vermont's rate of population growth.

has been increasing each year. This trend has added to the state's dependence on petroleum-based fossil fuels. As noted earlier, today's high gas prices have reduced miles driven.

Fuel economy standards have risen by only 0.4% from 1986 to 2007.<sup>12</sup> Hence, while more vehicles are being added to Vermont's roads and more miles are being driven each year, the number of miles per gallon of fuel consumption for standard passenger vehicles and light trucks has only increased slightly. With the recent run-up in the price of gasoline, it is likely that the modest increase in fuel economy standards will improve as car manufacturing and consumer jointly respond to market pressures.



**Trend Number 3:** Over the last decade, home heating costs in Vermont have been rising at double-digit rates.

Approximately 27% of Vermont's energy consumption is used for heating and business related processes such as manufacturing and cooling. Petroleum based fuels are the dominant forms of energy in this sector which are made up of fuel oil, natural gas and propane.

Approximately 60% of Vermont households use fuel oil to heat their homes. Natural gas makes up 12% of household heating in Vermont. This compares to the national average in which 51% of the U.S. uses natural

gas to heat their homes.<sup>13</sup> Ten percent is listed as "other," wood energy being the most important source. In Vermont, 6% of all heating and electricity comes from wood harvested in the state's forests.<sup>14</sup>

The following table summarizes home heating by various sources of energy.

Sources of Home Heating in Vermont in 2000		
Fuel Type	Vermont	U.S.
Natural Gas	12%	51%
Fuel Oil	59%	9%
Electricity	5%	30%
Propane	14%	7%
Other	10%	2%

**Based on Data from 2000 Data Source:** Energy Information Administration: [http://tonto.eia.doe.gov/state/state\\_energy\\_profiles.cfm?sid=VT](http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=VT)

In the short-run, Vermonters face constraints in the types of fuels that can be used to heat homes or businesses. Newer furnaces (and other technologies such as wind, solar or biomass) which provide homeowners or businesses with alternatives, are still costly and will only be introduced incrementally, assuming that heating costs remain high. Because the natural gas infrastructure in Vermont is limited, the state is particularly dependent on other petroleum sources for heating needs of residential and commercial buildings. Only the Northwestern portion of the state has any availability of natural gas. As shown in the map in the appendix, a pipeline begins in Highgate and serves heating loads as far South as Chittenden County area.

Another important aspect of heating fuels to consider for the Vermont consumer is cost. Prices for heating oil have increased significantly in the last 10 years. Heating oil prices today are nearly triple the price from 1998. Natural gas prices have also risen dramatically in the last 10 years. Residential natural gas prices increased by 148% from 1998.<sup>15</sup>

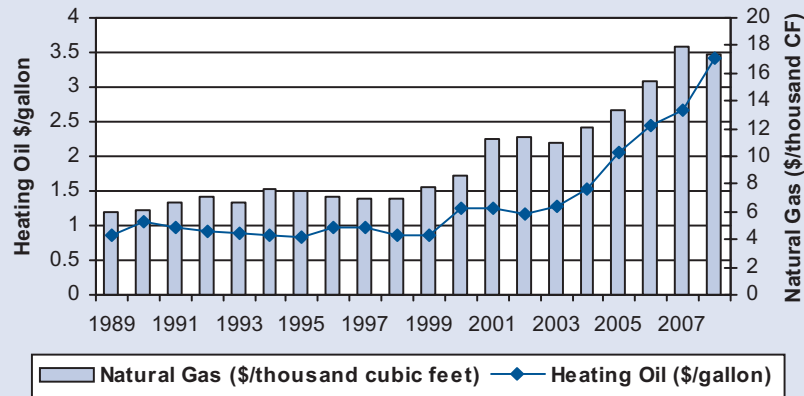
<sup>12</sup> Vermont Department of Public Service, Vermont Comprehensive Energy Plan 2009 (Draft), May 2008.

<sup>13</sup> Energy Information Administration: [http://tonto.eia.doe.gov/state/state\\_energy\\_profiles.cfm?sid=VT](http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=VT)

<sup>14</sup> North East State Foresters Association, The Economic Importance of Vermont's Forests, 2007," August 2007.

<sup>15</sup> Fuel oil prices from Energy Information Administration: <http://tonto.eia.doe.gov/dnav/pet/hist/d200111502m.htm> and natural gas prices from <http://tonto.eia.doe.gov/dnav/ng/hist/n3010vt3m.htm>

### Average Annual Price for Heating Oil and Natural Gas in Vermont 1989 to 2008

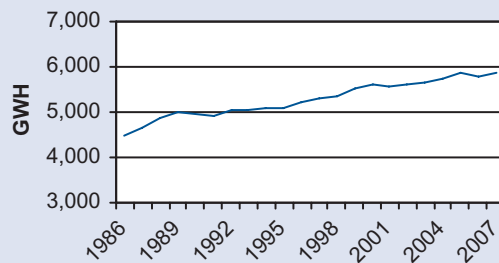


Source: Energy Information Administration:  
<http://tonto.eia.doe.gov/dnav/pet/hist/d200111502m.htm>

**Trend Number 4:** Per customer electric use has declined over the last decade, but overall demand is higher due to more customers coming online.

Vermont's total use of electricity has been on the rise over the past 20 years. In the past 10 years, consumer use is up 11%. That equates to just over 1% load growth per year.<sup>16</sup> This contrasts to the rate of growth in the US which is 1.7% per year. Therefore, Vermont's electricity growth rate is increasing, but at a lower rate than the national average.

### Vermont Retail Utility Sales (GWH) 1986 to 2007



Source: Vermont Department of Public Service, Annual Utility Data Statistics.

Despite the total increased electricity consumption in Vermont, some customer groups have recorded declining electricity use, including residential use per customer, which decreased by 13% from 1986 to 2007. Commercial and industrial consumers decreased their per customer use by 6% in that same period.<sup>17</sup> Energy efficiency and conservation efforts have reduced consumption rates. For example, many businesses switched to energy efficiency lighting and advanced motor drives that use less electricity. Residential consumers moved away from heating homes with electric baseboard heat and switched to more efficient lighting and appliances.

The cause of increased electricity consumption in the state of Vermont is from new consumers. In 1986, Vermont utilities reported 267,549 customers. By 2007, that number grew to 354,311. This is a 1.5% increase in the number of customers each year over a 20-year period.<sup>18</sup>

**Trend Number 5:** Vermont's electric supply portfolio has been stable for a number of years, but long-term contracts signed in earlier years will begin to expire in the next decade.

Electricity is a significant source of Vermont's total energy demand, comprising 40% of Vermont's total energy use. Energy demand has risen with increases in the number of households, appliances, electronic plug loads, the emergence of new information technologies and air conditioning loads that continue to drive summer peak demands to new highs.<sup>19</sup>

Vermont's existing electricity supply can be characterized as stable in the next few years. Two-thirds of Vermont's electricity supply portfolio comes from two resources. Vermont utilities have secured approximately a third of their energy requirements through a system of power contract with Hydro-Quebec, and a third through a unit-contingent energy contract with Entergy (owners of the Vermont Yankee nuclear power plant). The remainder of Vermont's mix is composed of in-state hydro (approximately

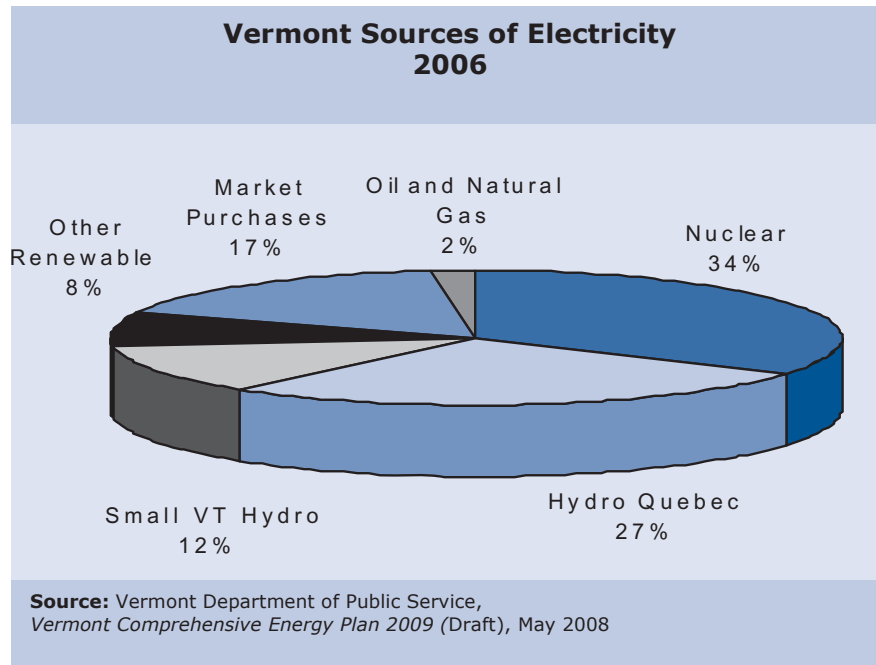
<sup>17</sup> Ibid.

<sup>18</sup> Ibid.

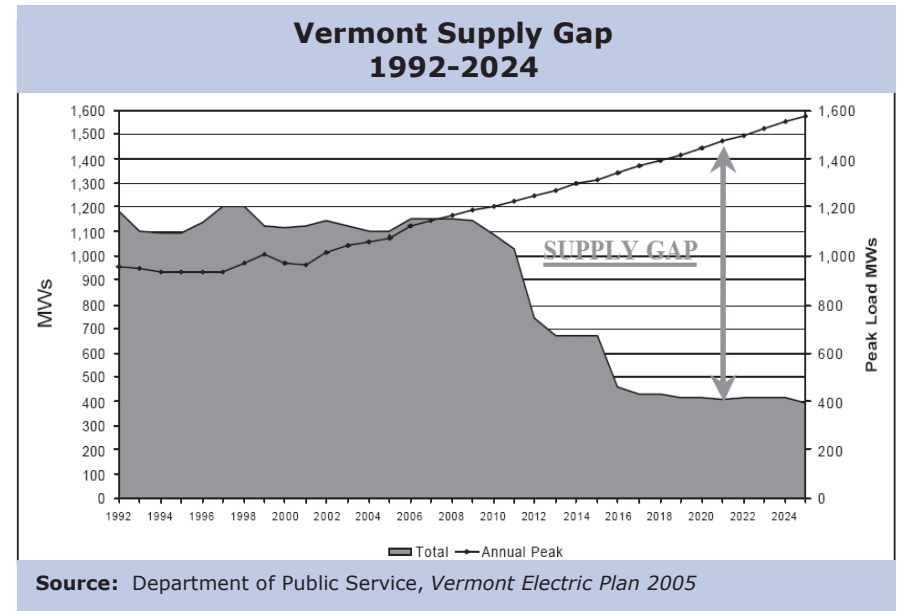
<sup>19</sup> Vermont Department of Public Service, *Vermont Comprehensive Energy Plan 2009* (Draft), May 2008

<sup>16</sup> Vermont Department of Public Service, Annual Utility Data Statistics

7% utility owned and 3% from contracts with independent power producers) and biomass (roughly 2.5% from utility-owned projects and 2.5% from independent contracts).<sup>20</sup> These statistics are very different from the national electricity supply portfolio, where coal plants supply 49% of electricity.



While today, Vermont has low emissions and a stable power portfolio, within the next ten years most of these contracts will expire. The Vermont Yankee contract expires on March 21, 2012, and the bulk of the Hydro Quebec contract expires in 2015. Independent power contracts, which currently account for roughly 6% of Vermont’s electricity needs, begin to expire in 2008, with the remaining contracts expiring by 2021.<sup>21</sup> The following graph shows the levels of Vermont’s energy supply if contracts are not renewed. Also included is a projection of Vermont’s peak demand over the same time frame. The area between demand and sources of power is referred to as the “supply gap.”



The expiration of electricity contracts, in conjunction with the projected increased demand for electricity may cause energy producers to increasingly rely on the New England wholesale markets if no action is taken. If this were to be the case, electricity would come primarily from natural gas fired power plants that dominate the New England mix of generators. While natural gas is one of the cleanest burning fossil fuels, it has limited deliverability in New England, and in the past decade the price for wholesale natural gas in New England has increased by over 300%.

The following graph shows the price of electricity in the wholesale market on a monthly basis from May, 1999 through June, 2008. Also included in the chart is the wholesale price of natural gas over the same time frame. As can be seen in the chart, the price of electricity is very closely matched to the patterns of the price of natural gas. In fact, there is a 91% correlation between natural gas and electricity prices in New England. By taking power from the wholesale markets, Vermont consumers would be exposed to price uncertainty, volatility, and rising electricity costs.

<sup>20</sup> Ibid.

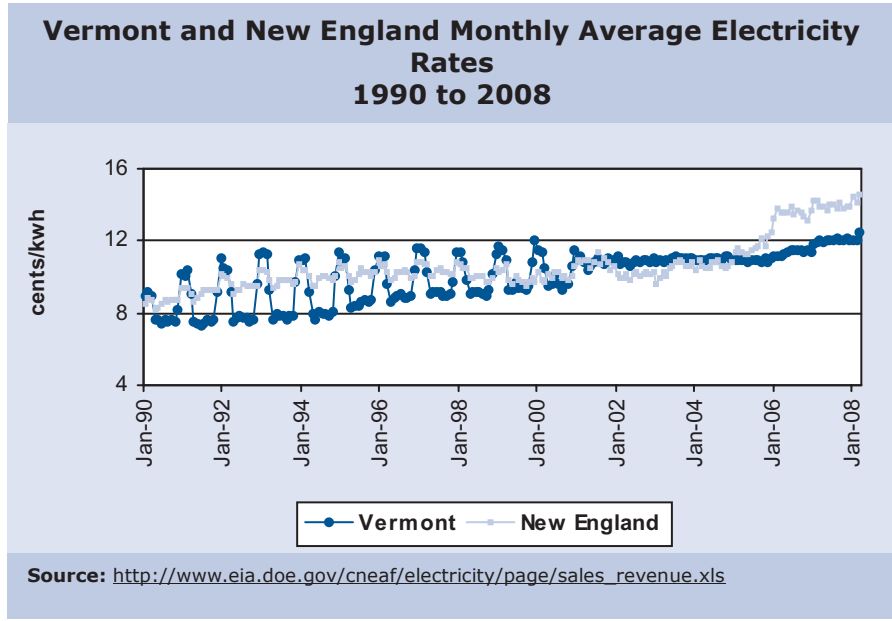
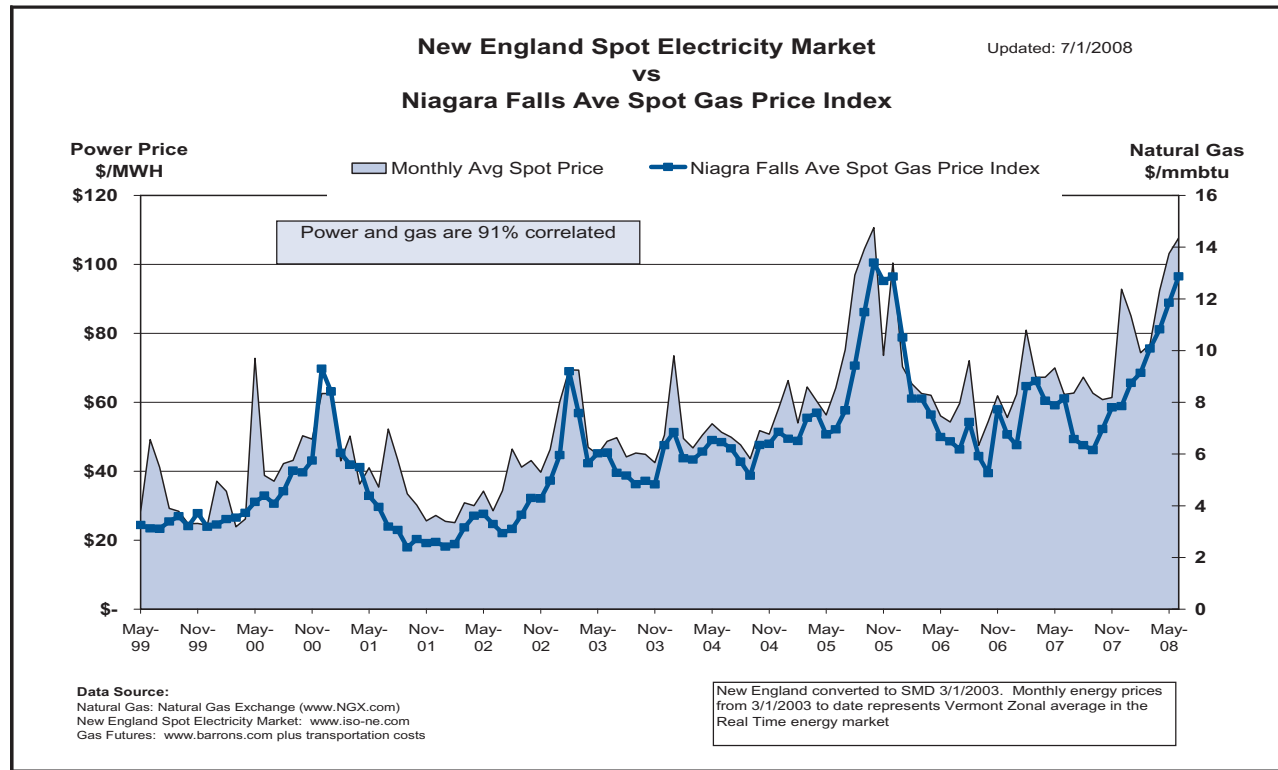
<sup>21</sup> Ibid.

*Trend Number 6: For a number of years Vermont electric rates were higher than other New England states, but over the last few years Vermont's rates have been well below its New England neighbors.*

Retail electric rates in Vermont are currently 15% below the regional average. For a number of years, regulators and some consumers complained Vermont's rates were too high relative to regional averages. That trend has reversed itself with the other New England states becoming significantly more expensive than Vermont, in large measure due to the other New England states moving to retail choice. In March of 2008, the New England average rate was 14.59 cents per kwh, while Vermont's average rate was 12.48 cents per kwh, which is 15% lower than the regional average.<sup>22</sup> Adjusting for inflation, Vermont's electric rates since 1990 have actually declined.

*Trend Number 7: Vermont's carbon emissions have been increasing, in spite of private and public efforts to conserve energy.*

According to the Worldwatch Institute, the earth's climate has been warming by 1.8 degrees Fahrenheit over the past century.<sup>23</sup> The 5 warmest years in the past century have occurred in the past decade alone. The relationship between energy use and climate change is largely accepted in the scientific community today. Beyond climate change, Vermont's lakes,



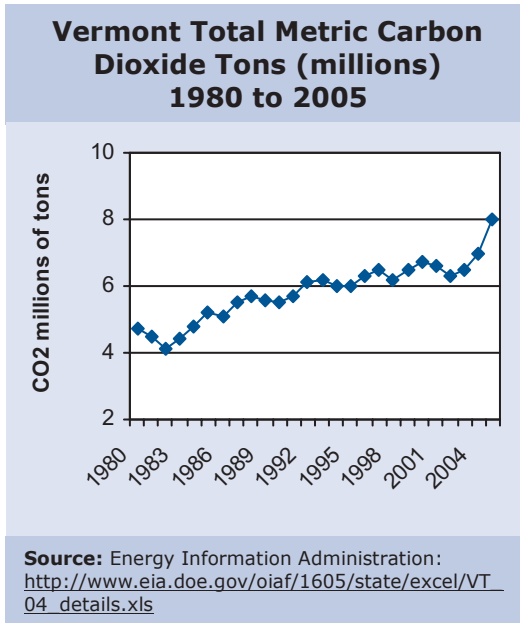
<sup>22</sup> Electricity Rates by State. Energy Information Administration: [http://www.eia.doe.gov/cneaf/electricity/page/sales\\_revenue.xls](http://www.eia.doe.gov/cneaf/electricity/page/sales_revenue.xls)

<sup>23</sup> The Vermont Energy Digest: An Inventory of Renewable Energy and Efficiency. Vermont Council on Rural Development April 2007. p. 5

forests, air and food crops are impacted negatively when toxins such as acid rain, mercury, and arsenic are released when oil and coal is burned. The cost of energy is important, but Vermonters are also concerned about the type of energy used.

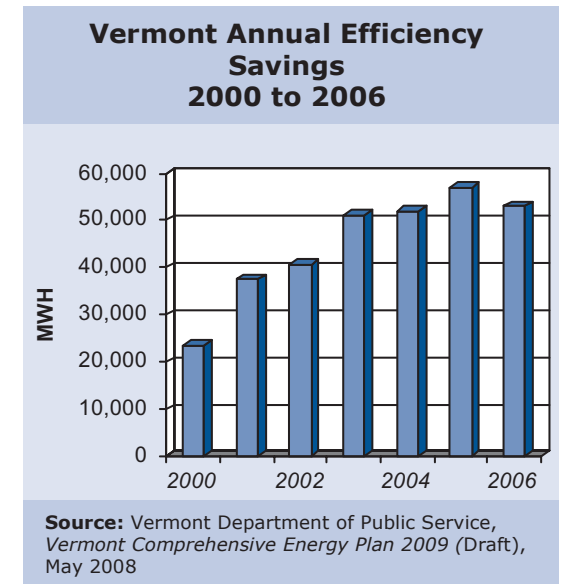
Globally, carbon dioxide emissions from energy consumption totaled roughly 28.2 billion metric tons in 2005. The United States produced almost 6.0 billion metric tons or 21% of the total world carbon dioxide emissions in 2005.<sup>24</sup> Vermont's carbon emissions total 8.0 million metric tons in this same time period. Although Vermont's carbon emissions are small in relation to the overall U.S. and global totals, Vermont's total emissions have grown by 2.3% per year since 1980, and the growth rate has accelerated since the turn of the current century.<sup>25</sup> While nationally transportation accounts for only a quarter of energy demand and less than a third of carbon emissions, in Vermont transportation accounts for 33% of the energy demand and roughly one-half of carbon emissions.<sup>26</sup> More information on other emissions is discussed in Chapter 2, the Environment and Climate.

It is also important to consider the impact of Vermont's expiring electricity contracts on future carbon emission levels. If low emitting sources of electricity are replaced with fossil fuel burning resources, Vermont may contribute significantly more carbon to the environment in the near



future. Like the rest of the country, Vermonters have a great interest and desire to replace expiring sources of power with renewable energy generation. Renewables that are being considered today in Vermont include wind, solar, hydroelectric, biomass and biogas. In 2005, only 14% of Vermont's electricity was generated by renewable energy sources, excluding large hydroelectric generation.<sup>27</sup> The high-energy prices of 2008 (along with growing concern over climate change) will encourage households, utilities, commercial enterprises, and government, to explore and expand their use of these renewable sources of energy.

Of course, the most environmentally benign source of electricity is that which is not used. Energy efficiency efforts in Vermont reduce and save electricity and fuel consumption, thereby creating less pollution and other negative impacts associated with power plants and household heating and transportation needs. Vermont was early and aggressive in the development and delivery of electric energy-efficiency programs. In the 1990s, utilities ran programs to encourage consumers to use more efficient end uses such as lighting, appliances, heating, and business processes. Some utility programs were more successful than others, but these programs were ultimately replaced with a uniform set of statewide programs. Beginning in 2000, a centralized delivery structure was created and a new utility was created: Efficiency Vermont. Over the past 7 years, Vermonters paid over \$85 million to fund Efficiency Vermont (approximately \$12 million per year). In that time frame, it is estimated that 314,667 MWh of electricity were saved.<sup>28</sup> In 2008, the legislature



<sup>24</sup> Energy Information Administration: <http://www.eia.doe.gov/iea/carbon.html>

<sup>25</sup> Energy Information Administration: [http://www.eia.doe.gov/oiaf/1605/state/excel/VT\\_04\\_details.xls](http://www.eia.doe.gov/oiaf/1605/state/excel/VT_04_details.xls)

<sup>26</sup> Vermont Department of Public Service, *Vermont Comprehensive Energy Plan 2009 (Draft)*, May 2008

<sup>27</sup> Vermont Department of Public Service, *Vermont Electric Energy Plan 2005*

<sup>28</sup> Vermont Department of Public Service, *Vermont Comprehensive Energy Plan 2009 (Draft)*, May 2008



increased funding to almost \$31 million per year. It is estimated that this level of funding could eliminate electricity load growth in Vermont, and thereby decrease some of the pressures to find new sources of power in the future.<sup>29</sup> The chart above summarizes annual efficiency savings accomplished by the Efficiency Vermont from 2000 to 2006. Over the past 7 years, the average rate of savings reported by the Efficiency Vermont has been 18% per year.<sup>30</sup>

In summary, the seven most notable trends in Vermont's use of energy are as follows:

1. Vermont energy use has been rising steadily over the last 45 year, at a rate greater than the national as a whole, although energy levels started at a lower base. The level of per capita energy use remains well below national standards.
2. Vermonters have been driving longer distances and registering more vehicles.
3. Over the last decade, home heating costs in Vermont have been rising at double-digit rates.
4. Per customer electric use has declined over the last decade but overall demand is higher due to more customers coming online.
5. Vermont's electric supply portfolio has been stable for a number of years, but long-term contracts signed in earlier years will begin to expire in the next decade.
6. For a number of years Vermont electric rates were higher than other New England states, but over the last few years Vermont's rates have been well below its New England neighbors.
7. Vermont's carbon emissions have been increasing, in spite of private and public efforts to conserve energy.

**For the appendices and for pdf versions of this report, please visit the Council on the Future of Vermont's website; [www.futureofvermont.org](http://www.futureofvermont.org) or visit Vermont Council on Rural Development at [www.vtrural.org](http://www.vtrural.org).**

## **The Appendix for this chapter contains the following chart:**

Map of natural gas pipeline in Vermont.

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<sup>29</sup> Ibid.

<sup>30</sup> Ibid.

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- I. Map of natural gas pipeline in Vermont.



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Map of Natural Gas Pipeline in Vermont

