FINAL: Chittenden County Energy Consumption and Production Analysis Report

On January 25, 2012 the Steering Committee accepted these Analysis Reports with the understanding that that as a part of the final ECOS product they remain open for amendment until the whole product is finalized.

1/25/2012

An ECOS Analysis Report

An Analysis of Energy Production and Use in Chittenden County and Discussion of Policies and Programs Relevant to Regional Energy Planning.

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A SUSTAINABLE FUTURE FOR CHITTENDEN COUNTY

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ECOS Project Introduction and Goals

The ECOS Project Steering Committee is a broadly-based 60+ member partnership committed to implementing strategies to improve Chittenden County's long-term sustainability: economically, environmentally and socially. The Steering Committee has committed to a five-phase project:

1. Adopt common goal statements;
2. Analyze reports regarding economic development, housing, energy, land use and transportation, natural resources and health/human services/education;
3. Develop indicators tied to the goal statements;
4. Prioritize implementation actions for the next five, ten and twenty years;
5. Invest in high priority implementation actions.

ECOS Energy Advisory Team Composition and Goals

Through the ECOS working group, an open invitation to join the Energy Advisory Team was released. The team was composed of the following entities:

- Burlington Electric Department
- Chittenden County Regional Planning Commission
- Green Mountain Power
- Vermont Electric Cooperative
- Vermont Fuel Dealers Association
- Vermont Gas

The content of this report was developed by VEIC in collaboration with the ECOS steering committees and provides background information on past and current energy use in order to understand current trends and provide context and data for the development of goals and indicators and aims to provide supporting documentation that can be used to pursue the following ideas:

- Reduce energy consumption through energy conservation and efficiency.
- Encourage the generation and use of renewable energy sources
- Support reliable transmission, and distribution infrastructure in Chittenden County.
- Reduce transportation costs and pollution

The objectives set by the ECOS Energy Advisory Team as a guide to its efforts and research toward the accomplishment of the above goals were to compile available information into a format that regional and town planners and administrators can use to consider the energy impact of their planning and decision-making.

Introduction

All Vermonters depend on energy to carry out their work and conduct their lives. As a northern New England state with cold winters, warm summers, and a rural and semi-rural landscape in many locations, the state's residents need space heat in the winter, cooling in the summer, and electricity and transportation fuels year round. As such, a significant proportion of the income of many Vermont households goes to paying energy bills, and energy is a significant expense for businesses, industries, and government as well.

The importance of reliable and affordable energy to the economic well-being of Chittenden County cannot be underestimated. In times of economic downturn, this becomes even more important as low income households and those living on fixed incomes find themselves making difficult choices among food, housing, the electric bill, heating, transportation, and medical care.

Vermont citizens, businesses, and industries spent over $2.5 billion on energy in 2009.[1] Much of this money leaves the state immediately (and in many cases the country). This outflow of energy dollars serves as a drain on the state and Chittenden County's economy.

Total energy consumption in Vermont can be divided among residential, commercial, industrial, and transportation sectors **Figure 1**,[2] Within the residential, commercial and industrial sectors, the energy consumption can be further divided between electricity consumption and predominately thermal needs; this topic is discussed in detail in the section on energy end-use. For this report, in some cases we apply the statewide sector split to Chittenden County due to lack of better available data. As energy consumption is an important issue across sectors and increasingly there are interactive effects among sectors, a sustainability plan needs to address each category.

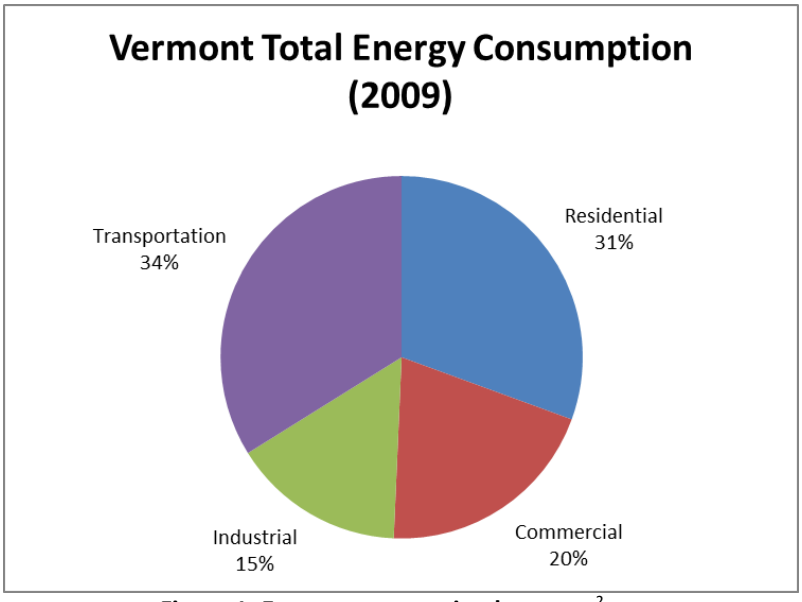

Figure 1: Energy consumption by sector[2]

[1] Energy Information Administration, State Energy Data System, Table ET 1 Total End-Use Energy Price and Expenditure Estimates, 1970-2009, Vermont, http://205.254.135.24/state/seds/sep_prices/total/pdf/pr_VT.pdf

[2] EIA SEDS State Energy Data System, Released: June 30, 2011, http://www.eia.gov/state/seds/seds-states.cfm?q_state_a=VT&q_state=Vermont#undefined

Highlights of Vermont energy consumption, energy efficiency, and transportation include the following snap shots and trends:

- Total energy consumption in Vermont is the lowest of any state in the Nation[3]
- Vermont has a long history of energy efficiency programs dating back to 1990 which have provided significant energy savings and economic benefits to the state.
- In 2011, Vermont was ranked by ACEEE fifth in the nation with respect to policies on energy efficiency, building energy codes, transportation, combined heat and power, appliances and state and government initiatives[4]. It ranks first in electric energy efficiency.
- Trends in energy consumption in Chittenden County show an overall increase in total energy usage in parallel to the population growth the county has been experiencing.
- Trends vary by fuel type and sector (residential, commercial and industrial, and transportation). For example, Chittenden county electricity use has decreased and natural gas use has increased.
- The per household or per employee energy consumption for several fuel types has shown a decline over the last 20 years, consistent with improvement in efficiency and more stringent standards.
- Chittenden County has many renewable energy production sites owned by utilities, private parties and municipalities
- There are several guidebooks and resources available to municipal planners to assist them in developing energy plans for their municipalities and to help them mobilize their communities to form local energy committees

Energy Data and Sources

This report provides a first step to develop an energy baseline for the region by 1) presenting an overview of energy trends over the past two decades, 2) describing Chittenden County current energy consumption, and 3) discussing energy supply and energy mix in the county.

This study did not involve any primary data collection and relied on sources of data that are already available either through publicly accessible data websites or through direct requests to organizations that do not publicly provide the specific data on an ongoing basis. Table 1 summarizes the sources of data used for the analysis section of this report and the type of data available through each organization. For municipal and regional planning purposes, data at the county or local level would be the most useful, but is often unavailable. In those instances the best data available was used to characterize Chittenden County. In some cases Vermont or national trends were adjusted using standard assumptions relating to the proportion of households and employees in the County and in the state as a whole.

[3] http://www.eia.gov/state/state-energy-profiles.cfm?sid=vt
[4] http://www.aceee.org/sector/state-policy/scorecard

Table 1: Overview of Available Data

	Type of data	Census region	State	County	City/ Town
U.S. Energy Information Administration	State Energy data system • Consumption by all fuel sources • End-use consumption by sector • Electric power sector fuel consumption		X		
	Energy consumption by end use for residential (RECS), commercial (CBECS) and manufacturing (MECS)	X			
U.S. Census Bureau	Population data	X	X	X	X
	Housing characteristics	X	X	X	X
	Business characteristics	X	X	X	
Woods and Poole[5]	Employee data			X	
	Population			X	
	Households			X	
Vermont Electric Utilities and Efficiency Vermont	Electric consumption and savings		X	X	X
Vermont Gas Utility	Gas consumption and savings		X	X	X
Vermont Energy Atlas	Renewable energy types, locations, and capacity		X	X	X
Transportation	Vehicle Mile Traveled by sector, Commercial trips by sector, Vehicle Fuel Efficiency	X	X	X	X
Efficiency Vermont	Energy savings data		X	X	X

[5] Data provided to CCRPC by Woods & Poole (http://www.woodsandpoole.com/) in 2010

Energy Trends in Chittenden County

Chittenden County Characterization

Chittenden County is composed of 19 municipalities (including one gore). Towns vary greatly in economic development and other characteristics, ranging from rural (e.g. Bolton), to urban (Burlington). Population density and employment are concentrated around Burlington. This diversity of town characteristics warrants an analysis of energy consumption at the Town level. Trend data are not available at the town level. An analysis of end-use consumption at the Town level was attempted, using relevant assumptions as required (Town level data is provided in an Excel file in Appendix B). Housing type varies greatly regionally as well, with a greater concentration of multifamily housing near Burlington (see ECOS report on housing for details). Business types vary greatly throughout the county, from a family- owned bakery, to the IBM facility in Essex Junction. Due to the wide variety of business types existing in the county, and the confidentiality of energy consumption data at the facility level, the commercial and industrial energy analysis was performed on a per employee basis, rather than a per business basis.

The population and number of jobs in Chittenden County has been steadily increasing since 1969 and could continue growing as predicted by some estimates (Figure 2, red line shows the beginning of forecasting).[6] Development trends vary by region (e.g., town center, suburban, rural, etc.) and the ECOS Historic Development and Future Land Use/Transportation Analysis report delves into this subject; therefore population and job forecasting will not be discussed in depth here.

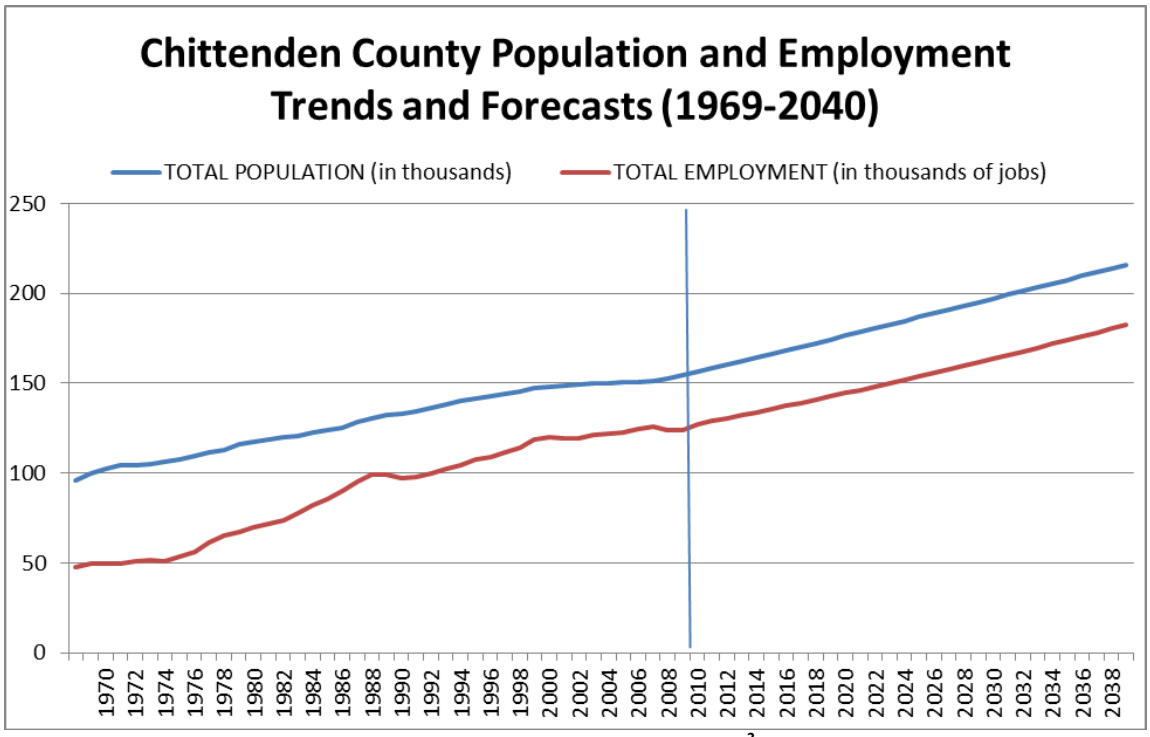

Figure 2: Chittenden County Population Trend[3]

[6] Data provided to CCRPC by Woods & Poole (http://www.woodsandpoole.com/) in 2010

This section focuses primarily on energy trends and uses population and jobs numbers when evaluating the per-household or per-employee energy consumption trends.

Trends data limitations and discussion: we were not able to identify a source of unregulated fuels data at the County and Town level as consumption trends by fuel type were not readily available for Chittenden County. We are presenting Vermont trends that have been scaled down by a ratio (25%, or the proportion of Chittenden County households of the total Vermont households). This ratio is not always ideal, as Chittenden County's proportion of natural gas availability for example is closer to 50%, and the number of accounts has increased over the years. Because Chittenden County households use more natural gas than elsewhere in the state, the ratio for other fuels appears greater than it should be. Therefore trends presented here should be considered at a high level rather than considering the exact values. Similarly, the trends for the C&I sector are scaled using the proportion of employees (33%) in Chittenden County compared to the rest of the State. Trends at the state level were obtained from EIA state profile 1990-2009.

Short term trends for electricity are specific to Chittenden County, but longer trends were extrapolated from the state level as described above. Vermont Gas trends data for Chittenden County by Town was not available at the time of this writing, so again statewide data was used.

Residential Trends

Natural Gas

Population growth in Chittenden County has resulted in an overall increase in residential (non-transportation) consumption of many fuels, including natural gas (Figure 3). Natural gas efficiency programs have mitigated some of this increase. Nevertheless, the per-household natural gas consumption has slightly increased since 1990 (Figure 4), some of this increase is likely to result from the use of statewide data extrapolated to Chittenden County assuming the number of natural gas customers increased at the same rate as population trends, and this is likely not to be the case (see Trends data limitations and). Natural gas may be used for heating or for appliances such as gas stoves, water heating, and gas dryers. Per-household consumption was calculated using state-level consumption data, adjusted to Chittenden County. A possible explanation of increased per-household consumption could be fuel-switching and increased popularity of hot water and cooking appliances fueled by natural gas as opposed to an increase per capita or decrease in efficiency. Natural gas can also be used to fuel vehicles, although this is not currently wide spread.

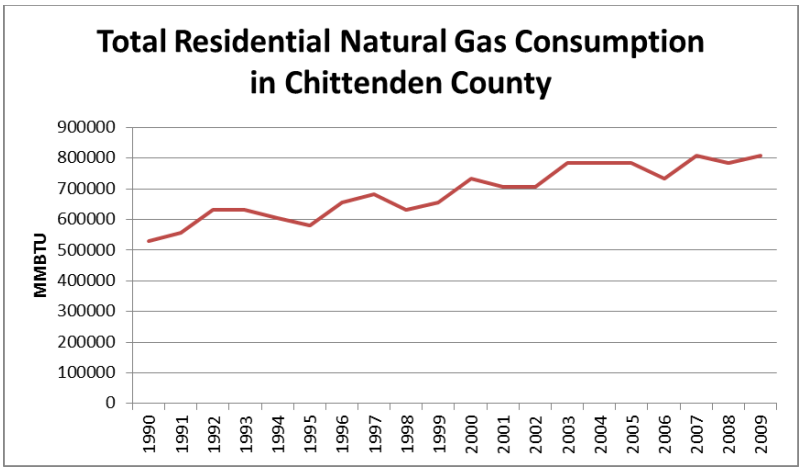

Figure 3: Residential Total Natural Gas Consumption in Chittenden County [7]

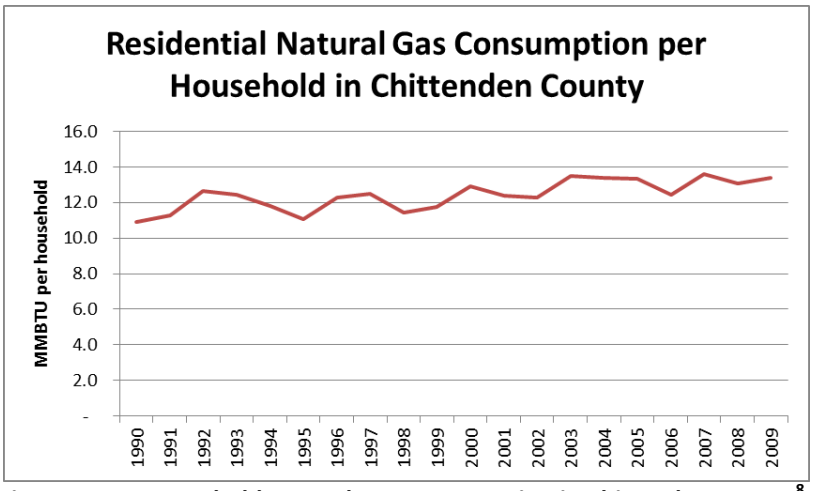

Figure 4: Per Household Natural Gas Consumption in Chittenden County[8]

Petroleum Fuels

The residential (non-transportation) consumption of petroleum fuels in Chittenden County has remained stable over the last two decades (Figure 5), which means, considering the County has experienced population growth, the per household consumption of non-transportation petroleum fuels has declined (Figure 6). Trends vary by petroleum fuel type, with distillate fuel oil showing the greatest decline, propane (or liquefied petroleum gas, LPG) showing a very slight increase in per household consumption and kerosene showing no clear trend. Kerosene is a minor component of the petroleum fuel use in Chittenden County and will not be discussed in great depth in this report. Oil is used essentially for home and water heating, whereas LPG may also be used for other appliances such as gas stoves and gas dryers. Declining trends could be a result of increased efficiency and fuel switching.

[7] http://www.eia.gov/state/seds/seds-states.cfm?q_state_a=VT&q_state=Vermont
[8] http://www.eia.gov/state/seds/seds-states.cfm?q_state_a=VT&q_state=Vermont

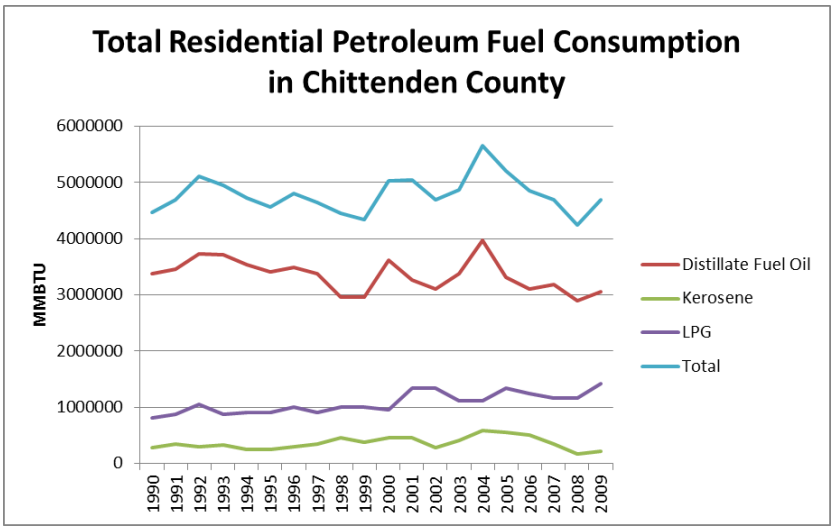

Figure 5: Residential Non-transportation Petroleum Fuels Consumption in Chittenden County[9]

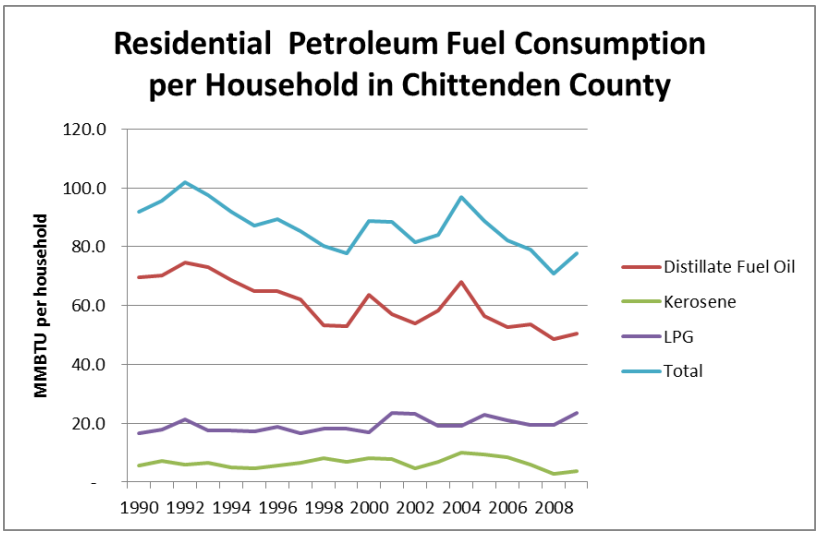

Figure 6: Per Household Non-transportation Petroleum Fuels Consumption in Chittenden County[10]

Wood

Residential consumption of wood for heating shows an overall increase of both total county level consumption and per household consumption (Figure 7 and Figure 8). The trends vary sharply from decade to decade, with a lower consumption in 1997-2004. The high variability in wood consumption may be explained by the prevalence of wood stoves as secondary heat sources. Because households can chose to use more or less wood depending on their primary fuel price, on weather, and on the availability and price of cord wood and other fuels, trends are less consistent than for other fuels (such as oil for example). In recent years, the increased popularity of cord wood stoves, pellet stoves, and

[9] Ibid.
[10] Ibid.

boilers, as well as higher petroleum fuel prices may all explain the overall upward trend in residential wood consumption.

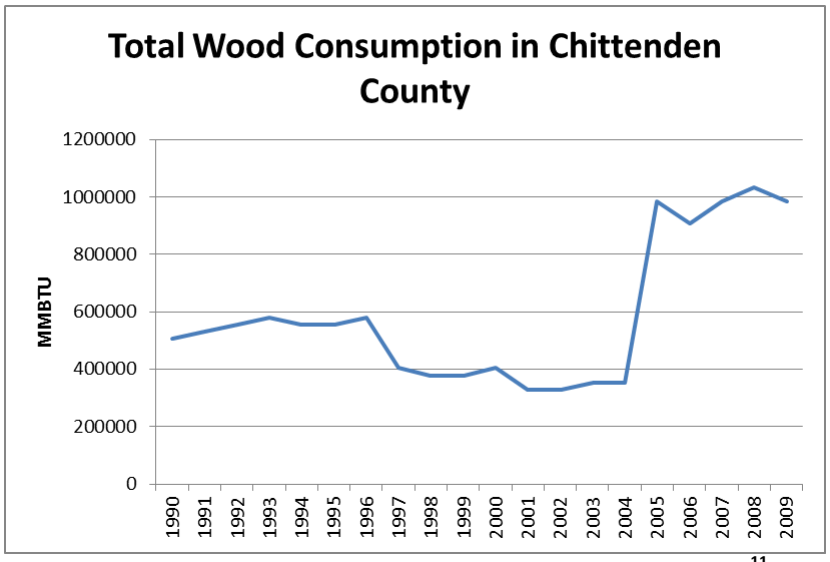

Figure 7: Residential Wood Consumption in Chittenden County[11]

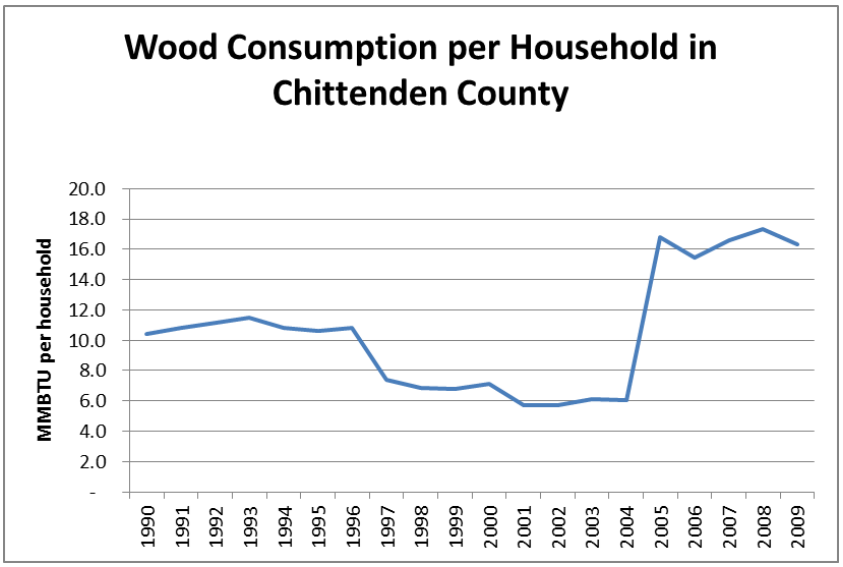

Figure 8: Per Household Wood Consumption in Chittenden County[12]

Electricity

Residential electricity use in Chittenden County increases (Figure 9) along with the increase in population growth, however per household consumption is decreasing (Figure 10), due to successful efficiency improvements (federal standards and energy efficiency programs) and increased awareness of

[11] Ibid.
[12] Ibid.

the economic and environmental costs associated with energy consumption. As discussed further in a following section (Consumption by End-Use), the use of electricity for heat is very low. Electricity is used in Chittenden County homes primarily for lighting, appliances (kitchen and laundry), water heating, and for an increasingly large plug-load (electronics, home computers, televisions, portable devices charging devices, etc.). Pool and spa pumps and pool heaters also require a lot of electricity, and forecasts of pool ownership as well as electronics and appliances would be helpful in predicting energy use for the future. Electricity also can be used to power vehicles either "plug-in hybrids" or electric vehicles but is not yet wide spread in Chittenden County (further discussed below).

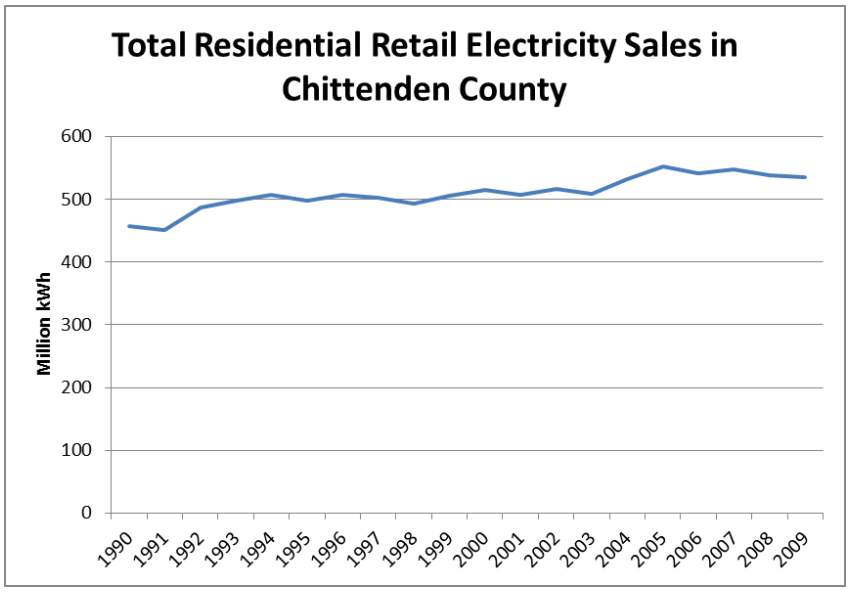

Figure 9: Total Residential Electricity Sales in Chittenden County[13]

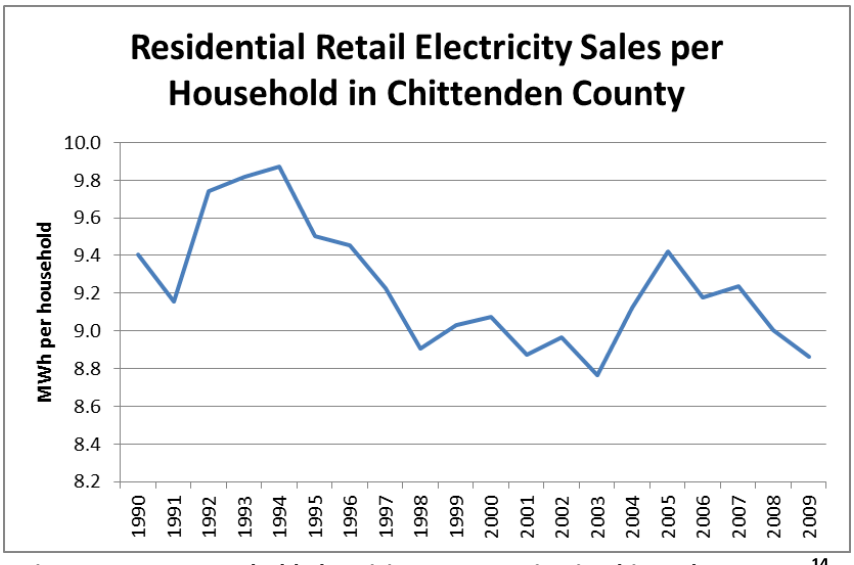

Figure 10: Per Household Electricity Consumption in Chittenden County[14]

[13] Ibid.

Commercial and Industrial Trends

Natural Gas

The number of employees in Chittenden County has increased over the last two decades, along with growth in population and businesses. Similar to residential natural gas consumption, commercial and industrial gas consumption is increasing, but per employee consumption remains relatively stable. The per-employee trend could reflect the fact that businesses are very aware of the cost of energy and are taking measures to limit their consumption. Natural gas is used for heating, hot water, cooking and industrial processes in commercial and industrial facilities. It is also used for transportation; for example UVM buses and Casella Waste Management trash haulers run on compressed natural gas.

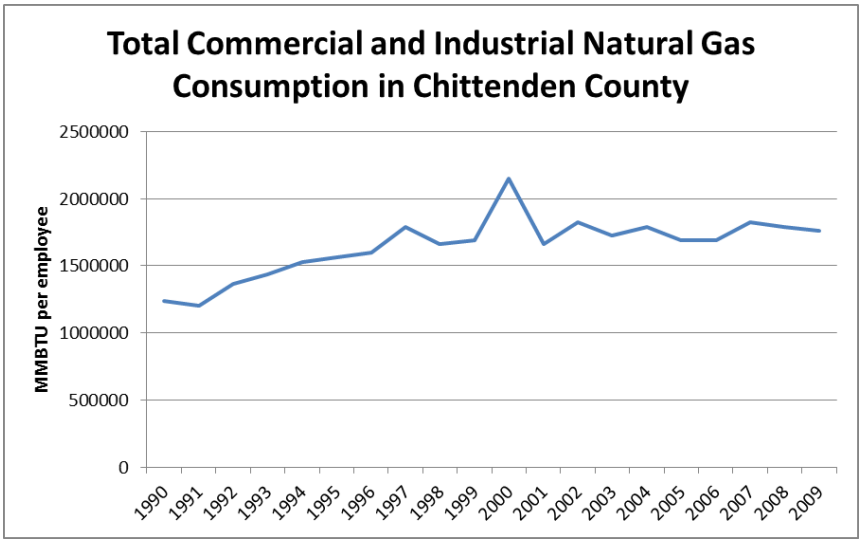

Figure 11: Commercial and Industrial Natural Gas Consumption in Chittenden County[15]

[14] Ibid.
[15] Ibid.

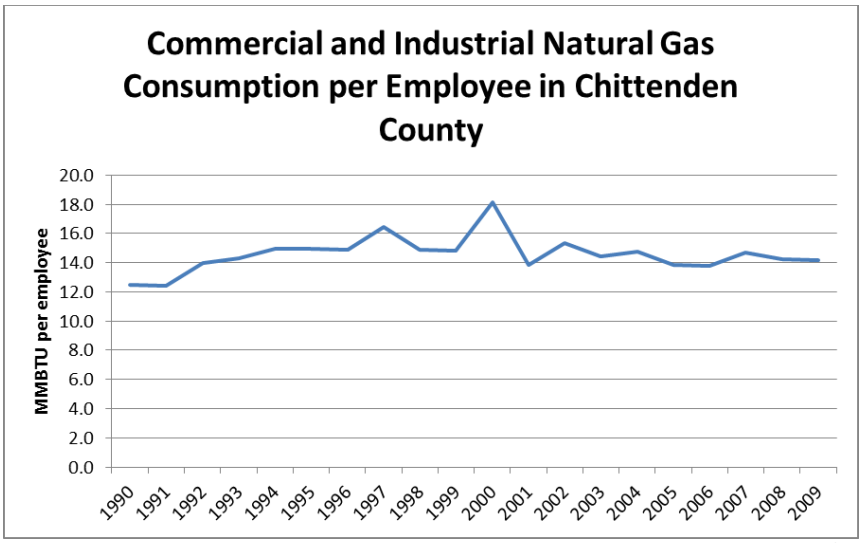

Figure 12: Per Employee Natural Gas Consumption in Chittenden County[16]

Petroleum Fuels

Commercial and Industrial non-transportation petroleum fuel consumption has increased and decreased irregularly until 2005 and appears to be showing a leveling or declining trend since 2005, although the future will tell if this is a short-term trend due to the recession or a longer-term trend. Liquefied Petroleum Gas shows a slight increasing consumption trend and residual fuel oil a decreasing trend. Per employee consumption decreases for petroleum fuels in general, and for distillate fuel oil; trends for other fuels are unclear. Petroleum fuels are used for heating, hot water, cooking and industrial processes.

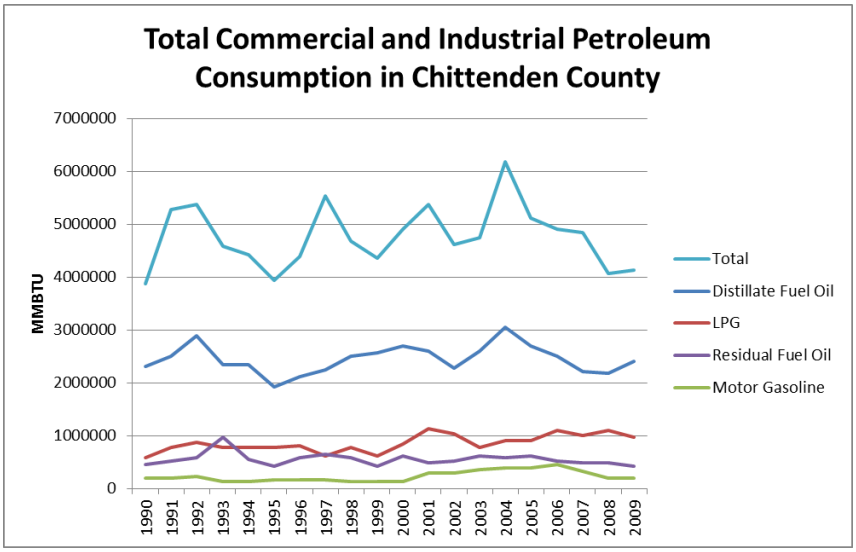

Figure 13: Commercial and Industrial petroleum Fuels Consumption in Chittenden County[17]

[16] Ibid.
[17] Ibid.

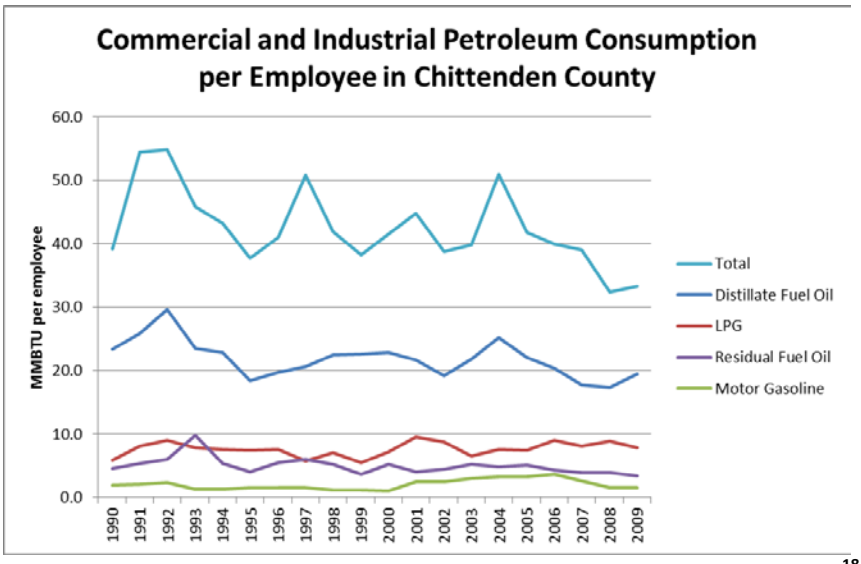

Figure 14: Per Employee Petroleum Fuels Consumption in Chittenden County[18]

Wood and Wood Waste

Trends in commercial and industrial wood waste consumption seem to indicate an overall decline in consumption, especially per employee consumption. The data includes wood, wood-derived fuels, and biomass waste and prior to 2001, also includes non-biomass waste. Analyzing the trend is difficult because different fuel types (non-biomass waste) included in the data in different years may bias the trend. Nevertheless as for the residential sector, the price of fuels and the price of wood products (other than energy, such as lumber, pulp and paper, etc.) for wood will affect a business's choice to use wood as a fuel.

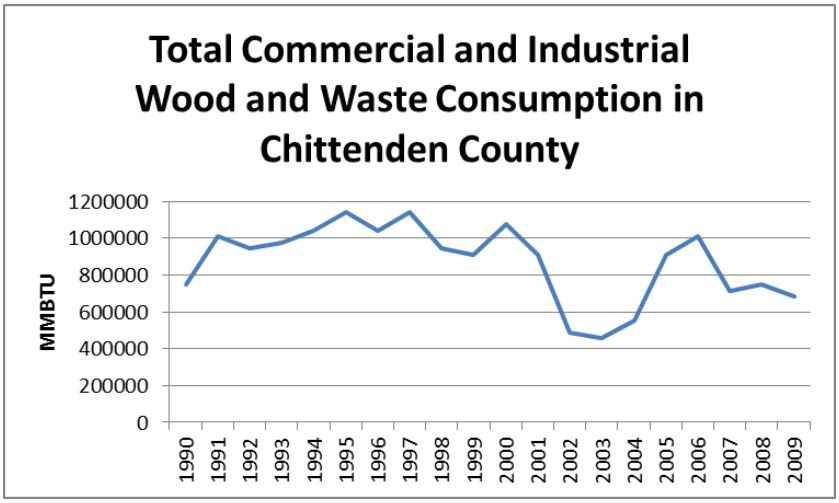

Figure 15: Commercial and Industrial wood and waste consumption in Chittenden County[19]

[18] Ibid.
[19] Ibid.

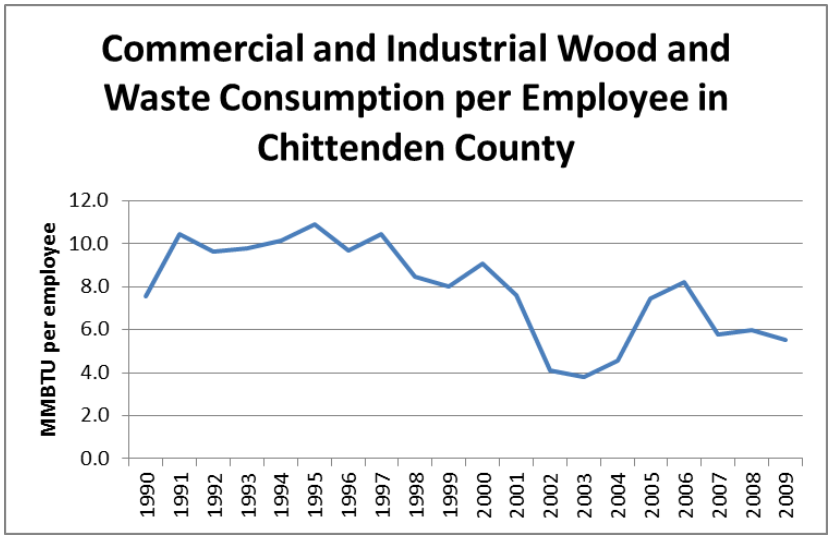

Figure 16: Per employee wood and waste consumption in Chittenden County[20]
(read Trends data limitations and before referencing this data)

Electricity

Commercial and Industrial electricity consumption in Chittenden county overall increased until about 2005, when the consumption leveled and even declined over the last 5 years. The per employee consumption trend is variable but overall shows an increase until the late 90s when the per-employee consumption appeared to level off. Electricity is used for lighting, cooling, heating, domestic hot water and cooking. It can also be used by vehicles for transportation.

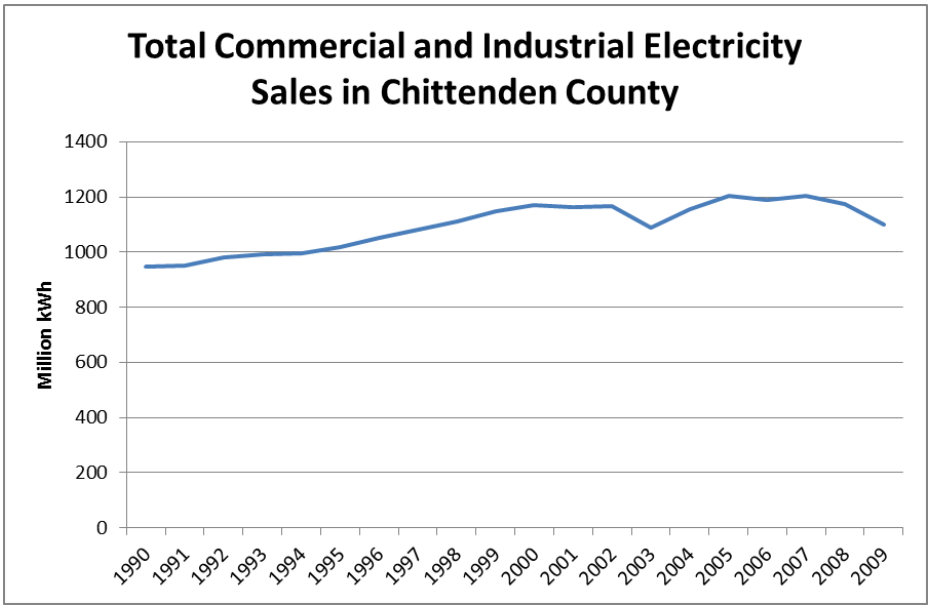

Figure 17: Commercial and Industrial Electricity Sales in Chittenden County[21]

[20] Ibid.
[21] Ibid.

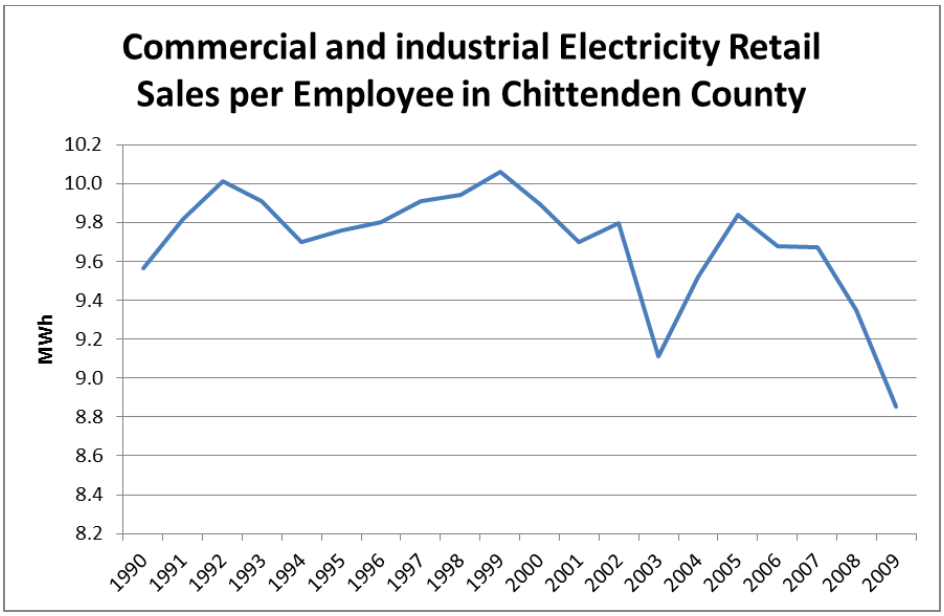

Figure 18: Per Employee Electricity Sales in Chittenden County[22]

Transportation Trends

Along with population growth, gasoline consumption in Chittenden County has increased (Figure 19), as more residents drive to and from work, run errands, and consume more goods, resulting in an increase in merchandise transport. Consumption of fuel ethanol seemed to have picked up in 2005 and has been growing exponentially since (note: starting in 1993, motor gasoline includes ethanol blended in the product). Societal factors affect transportation trends such as land use patterns (e.g. suburban sprawl requires more driving than well-designed and pedestrian-friendly urban centers with all required amenities located within a short distance). Demographics trends also impacts transportation needs (e.g. populations of different ages have different needs due to limited mobility, school-age children, etc.). The energy sector and land-use planning are closely connected on the transportation side.

[22] Ibid.

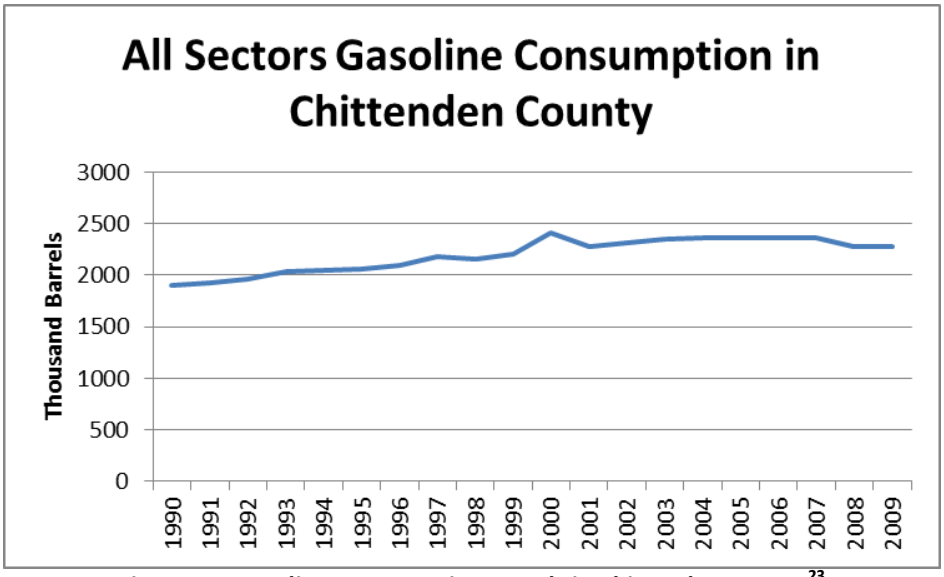

Figure 19: Gasoline Consumption Trends in Chittenden County[23]

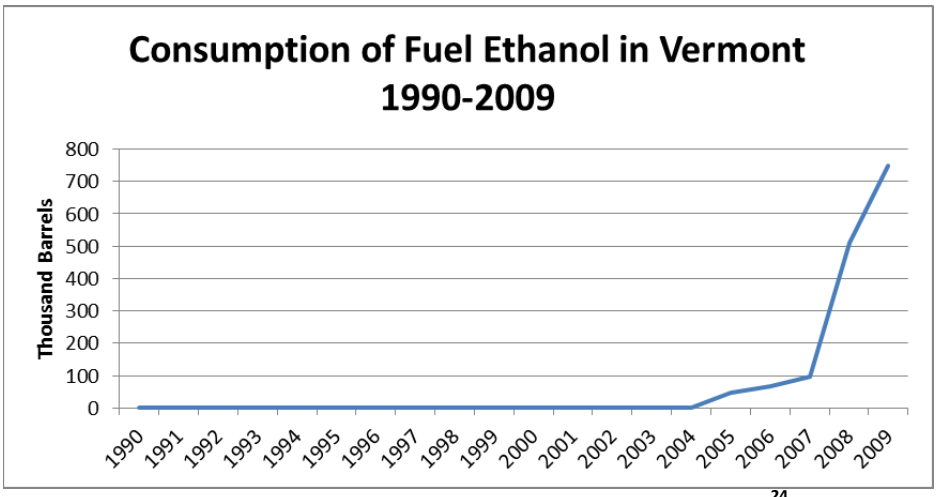

Figure 20: Fuel Ethanol Consumption Trends in Vermont[24]

Trends and Forecasting Conclusion

As illustrated by the trends presented above, forecasting of energy consumption in Chittenden County is extremely complex. Population trends only represent one of the factors affecting trends and forecasts. Others affecting energy consumption include: progress in efficiency and standards, price of fuels, land use, housing type, changes in the mix of business types, weather, health of the economy, popularity of certain products (e.g., wood stoves, consumer electronics), etc. While complex, these forecasts are necessary for the development of a sustainability plan that can establish realistic goals and be evaluated according to indicators grounded in reality. Due to the extrapolation of statewide data to Chittenden

[23] based on EIA statewide trends and assuming that Chittenden County's share of gasoline consumption is proportional to its share of households and employees
[24] Ibid.

County, precise conclusions and comments on the magnitude of the trends is unfortunately not likely to be accurate. Collection of county level data would be necessary going forward to precisely record progress towards any goals established through the ECOS project.

Consumption by End-Use

Understanding how Chittenden County uses energy is a complex undertaking but is important for planning purposes to be able to target efforts to reduce consumption appropriately. Energy consumption can be disaggregated first into sector like transportation (residential and commercial and industrial) and buildings (residential and commercial and industrial). Then with in each sector, the energy use can be assigned to categories like lighting, heating, hot water, appliances, consumer electronics and industrial process for buildings. For transportation, example end-use categories are residential trips from home to various destinations, trips in and out of the county, commercial light, medium and heavy trucking.

In the follow in sections residential, commercial and transportation energy end-use distributions are examined.

Residential

Residential energy consumption can be broken down by fuel type and by end-use. End-use data is usually obtained through customer surveys and Vermont has conducted several surveys particular to the state but they are not extensive enough to produce data at the county or town level. Regional data available through EIA *Residential Energy Consumption Survey (RECS)* and national trends often apply to our region as well and can be used to get a general idea of end-use energy consumption. For example, the following national trend in energy use would apply to some degree to Chittenden County:[25]

> *Over the past three decades, the share of residential electricity used by appliances and electronics in U.S. homes has nearly doubled from 17 percent to 31 percent, growing from 1.77 quadrillion Btu (quads) to 3.25 quads. This rise has occurred while Federal energy efficiency standards were enacted on every major appliance; overall household energy consumption actually decreased from 10.58 quads to 10.55 quads, and energy use per household fell 31 percent. Federal energy efficiency standards have greatly reduced consumption for home heating. Total energy use in all U.S. homes occupied as primary residences decreased slightly from 10.58 quads in 1978 to 10.55 quads in 2005 as reported by the most recent consumption and expenditures data from the Residential Energy Consumption Survey (RECS). A dramatic reduction in the energy needed to heat homes, along with other efficiency improvements, led to a 31 percent reduction in energy use per household. As a result, total residential energy consumption remained virtually the same.*

[25] http://www.eia.gov/consumption/residential/reports/electronics.cfm

The above text is shown another way in these graphs:

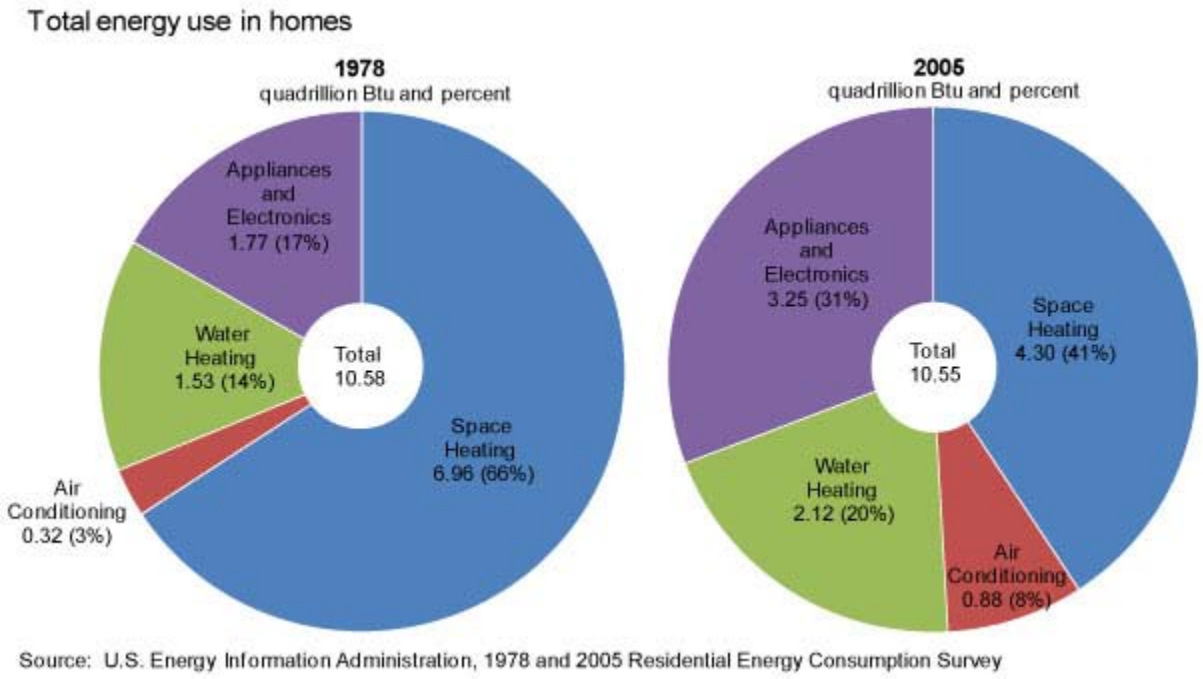

Figure 21: Federal level data on changes in total energy use in homes

Chittenden County Electricity Consumption by End-Use

In a typical Vermont and Chittenden County home, the categories responsible for the largest share of electricity consumption are lighting, appliances, and consumer electronics, which are present in virtually every home. Other end-uses (e.g. pool pumps, electric heat) are not necessarily present in every home but when they are present they can represent a significant load; **Error! Reference source not found.** and Table 2 provide an average for all homes.

In general, consumer electronics are responsible for a larger and larger share of the total plug load. This is due in part to the rise in the number of devices requiring chargers, an increased penetration of personal computers in homes, and changes in technologies used for television. Electricity consumption by electronic devices can be mitigated by unplugging chargers, ensuring that devices are off rather than on standby (addressing what is often referred to as *phantom load*), and selecting energy efficient devices in the first place (e.g. ENERGY STAR labeled). Phantom load can be greatly reduced by using *Smart Strips*, power strips that shut down all devices (e.g. game consoles) connected to a master (e.g. a television) when the master is turned off. The electricity consumed by appliances and lighting can be greatly reduced by selecting energy efficient products (e.g. ENERGY STAR labeled). The energy required to heat or cool a home can be reduced by insulation and air sealing improvements. Energy efficiency programs offered in Chittenden County provide assistance and incentives to take these efficiency steps. It is expected that in the future, electricity consumption by end use will continue to shift as federal standards (e.g. Energy Independence and Security Act of 2007- EISA) are implemented, federal energy

standards continue to improve (e.g. limits on consumer electronics standby consumption to <1 kWh), new technologies emerge, and consumer preferences evolve. As such the end-use analysis provided in this report is a snapshot in time. Currently, electric vehicles represent a very small proportion of the electric load because of low market penetration. If electric vehicles were to become more prevalent in Chittenden County, those vehicles would have to be included in the end-use analysis. The impact of electric vehicles on the electric grid will in part be dependent on when vehicles are re-charged. A large number of electric vehicles plugged in during peak hours would increase the peak demand of electricity and might require the upgrade of the grid to handle the additional peak demand. If cars are charged mostly off-peak, during the night for example, peak demand would not be affected to the same degree, but there would still be in increase in electricity consumption from this new category. The increase in electricity consumption would be mirrored by a reduction in gasoline and diesel consumption. Electric vehicles are also discussed in the Transportation section.

This split among end-uses varies regionally. Penetration rates appropriate for Chittenden County (county, state, or regional data, as available) were used to estimate the electricity consumption by end-use for Chittenden County (summary presented in Table 2). The estimated split of electricity consumption in Chittenden County is overall very similar to what occurs elsewhere in the nation and is dominated by appliances, consumer electronics, and lighting.

Table 2: Electricity consumption by end-use in Chittenden County[26]

Estimated Consumption per End Use in 2009[26]	Total kWh	Percent of Total	Annual kWh per household
Electric Heat/Furnace Fans/Humidifier	43,549,000	10%	688
Cooling/ Dehumidifier	24,216,717	5%	383
Hot Water	31,447,446	7%	497
Lighting	77,777,675	18%	1,229
Kitchen Appliances	84,419,504	19%	1,350
Laundry Appliances	46,344,173	10%	732
Consumer Electronics (TV, Computers, and Accessories incl. rechargeable portable devices)	83,179,062	19%	1,315
Spa/Pool	11,067,114	2%	175
Other	40,022,703	9%	633
Total electricity	443,019,394	100%	7,001

[26] Efficiency Vermont Town Level Data http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx End-use assumptions are available in the Excel file in Appendix and in Appendix A.

Chittenden County Thermal Fuel Consumption by End-use

Different fuel mix assumptions need to be used in Towns that have access to natural gas, and Towns that do not. Natural gas is one of the more cost-effective options for hot water and heat and, when available, it is often a fuel of choice for these end uses. Fuel mix assumptions used in the end-use analysis and results of the analysis on consumption by fuel type and end-use are presented in

Table 3,

Table 4, and in the Excel file in Appendix B.

Table 3: Thermal fuel disaggregation (non-transportation) at the County level[27]

	Fuel	Category	Total (MMBTU)
Fossil Fuels (MMBTU)	Natural gas	Number of households	35,230
		Space Heating	1,803,286
		Water Heating	337,151
		Kitchen	226,285
		Laundry	204,977
		Other*	107,219
		Total consumption (MMBTU)	2,688,773
	Oil	Number of households	25,836
		Space Heating	1,117,657
		Water Heating	124,184
		Kitchen	-
		Laundry	-
		Other*	-
		Total consumption	1,241,841
	Propane	Number of households	6,546
		Space Heating	103,387
		Water Heating	24,755
		Kitchen	17,474
		Laundry	-
		Other*	-
		Total consumption	145,615
	Wood	Number of households	5,673
		Space Heating	87,888
		Water Heating	-
		Kitchen	-
		Laundry	-
		Other*	-
		Total consumption	87,889

[27] Efficiency Vermont Town Level Data http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx End-use assumptions are available in the Excel file in Appendix B and in Appendix A.

*Other = gas cooktop and gas oven, gas laundry dryer, pool heater

Table 4: Electricity used for thermal needs (MMBTU) -2009

Electric primary heat only, annual consumption MMBTU	148,589
Hot water, annual consumption MMBTU	107,299

Residential Town Level Data

A lot of assumptions on penetration rates, units of electricity consumption, and number of households using each type of fuel go into calculations of energy consumption by Town and by end use. Those assumptions and calculations are provided in Appendix B and should be reviewed prior to referencing this data. Overall calculations of fuel consumption by Town (**Error! Reference source not found.**) show that the main difference among Towns is whether they have access to natural gas or not. Overall Town energy consumption varied between 68-101 MMBTU per year, however the precision of the data is not such that valid detailed comparisons can be supported.

Electricity and natural gas data is the most accurate, as it was provided at the town and sector level by the utilities. Unregulated fuel data (oil, propane, wood) is state level data extrapolated to the Town level using several assumptions. Burlington and Winooski have lower electricity consumption, possibly due to the greater proportion of multi-family housing buildings, with different consumption patterns than single-family homes dominating other Towns. Buel's Gore has very few homes, and any outlier in this Town will have a much greater impact on the average, which would explain the much lower electricity consumption. Charlotte and Shelburne have higher electricity consumption than the average. This could be due to differences in the housing stock (e.g. larger homes). Natural gas consumption by household by Town varies as natural gas service has reached a different proportion of the housing stock in different Towns.

Table 5: Estimated Per Household Aggregated, Residential (non-transportation), Energy Consumption by Fuel Type and by Town in Chittenden County (total Town MMBTU consumption/ total number of household in the Town, regardless of the number of households using each fuel as primary fuel)

Town	Per household MMBTU consumption					
	Electricity	Oil	Natural Gas	Wood	Propane	Total
BOLTON	24	48	0	3	6	82
BUELS GORE	10	48	0	3	6	68
BURLINGTON	18	9	57	1	1	86
CHARLOTTE	30	48	0	3	6	88
COLCHESTER	24	20	36	1	2	84
ESSEX	26	13	59	1	2	101
ESSEX	23	16	53	1	2	95

JUNCTION						
HINESBURG	25	37	7	3	4	76
HUNTINGTON	24	48	0	3	6	81
JERICHO	27	30	24	2	4	88
MILTON	26	26	27	2	3	84
RICHMOND	26	48	0	3	6	84
SHELBURNE	30	21	46	2	2	101
SOUTH BURLINGTON	22	13	58	1	2	96
ST. GEORGE	26	48	0	3	6	83
UNDERHILL	27	40	6	3	5	80
WESTFORD	28	48	0	3	6	85
WILLISTON	25	19	43	1	2	91
WINOOSKI	19	11	54	1	1	86
Average	**23**	**20**	**42**	**1**	**2**	**89**

Chittenden County Commercial and Industrial

Finding Chittenden County specific data on end use distribution in commercial and industrial buildings is much more difficult than for the residential sector. Commercial and industrial buildings vary greatly in size, construction type, purpose and operating hours to a much greater extent than residential structures. The energy use of a hospital with round the clock operation, food services, laundry facilities, laboratories and high demands on HVAC with will be much different than an office building or a grocery store, so to gather effective data, more buildings would need to be included which is a very expensive undertaking and why it happens less frequently and with less specific data than the residential surveys.
The available end-use data is from EIA Commercial Buildings Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS). The CBECS data was updated in 2007 but the EIA web page reports that there were flaws in the data collection methodology and the results were not high enough quality to be posted. Therefore the data from 2003 was used. The most recent MECS data is from 2006 and is currently going through a 2010 update. For end-use CBECS is aggregated to the census region then by the division of New England. Energy use data categorized by building type is aggregated at the national level.

Given all of these issues, we would like to emphasize that information available by end-use for commercial and industrial for Chittenden County is much less rigorous than the residential sector, but because it's the best data available, we can use it to gain some insight into the way energy is used in Chittenden County. Commercial buildings in the Northeast use most of their energy for space heating (55%), followed by lighting (16%). The rest of the energy is distributed across electronics (office

equipment, and computers) water heating, ventilation, cooling and miscellaneous as shown in Figure 22[28].

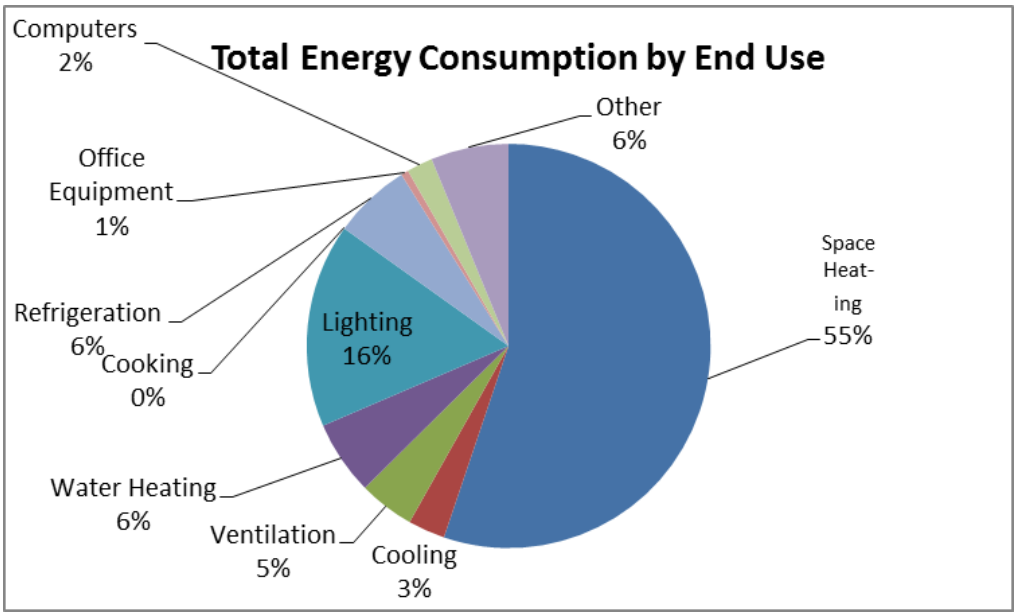

Figure 22: Commercial Energy Consumption by end use (non-transportation) for New England[29]

Commercial and Industrial Electric Consumption by End-use

Commercial and industrial buildings use electricity for lighting, HVAC, refrigeration office equipment and for processes. The highest use of electricity is for indoor and outdoor (which includes street lighting). This percent should shift downward as the federal lighting standard EISA phase in requiring higher efficiency lighting in typical commercial fixtures and lamps. Figure 23 and Table 6[29] show the estimated end-use disaggregation for electricity and electric use per employee.

[28] http://www.eia.gov/emeu/cbecs/

29 Data source http://www.eia.gov/emeu/cbecs/ and VEIC internal planning documents

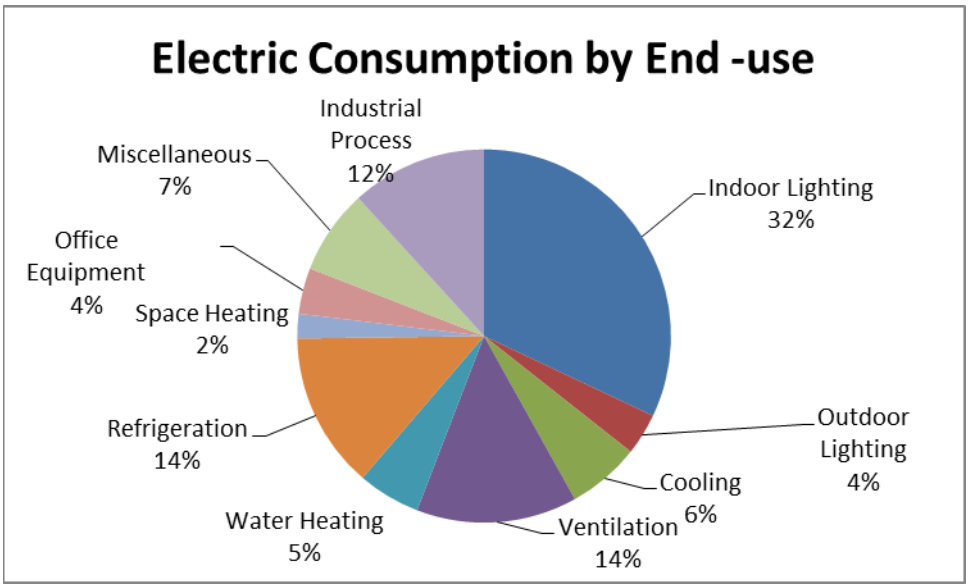

Figure 23: C&I Electric Consumption by End-use

12

Table 6: C&I Electric End-use disaggregation

Electric (kWh) 2009	All Building Types	Percent	Per Employee
Indoor Lighting	248,545,499	32%	2,003
Outdoor Lighting	27,997,869	4%	226
Cooling	48,767,127	6%	393
Ventilation	108,050,725	14%	871
Water Heating	42,049,939	5%	339
Refrigeration	104,915,881	14%	845
Space Heating	16,509,564	2%	133
Office Equipment	30,853,869	4%	249
Miscellaneous	57,037,236	7%	460
Industrial Process	91,241,826	12%	735
Total	**775,969,536**		

Commercial and Industrial Thermal Disaggregation

The highest use of energy for fuel types falls into the category of space heating. Natural gas and propane can be used for cooking, water heating, space heating and industrial processes. Oil and kerosene are used for space heating, water heating and process. Figure 24: C&I Natural Gas Consumption by End-use and Table 7 show natural gas end-use and per employee use. Figure 25 and Table 8 show oil and kerosene and Figure 26 and Table 9 show propane[30].

[30] Natural gas data is 2010 from Vermont gas. Oil and propane are 2009 from EIA

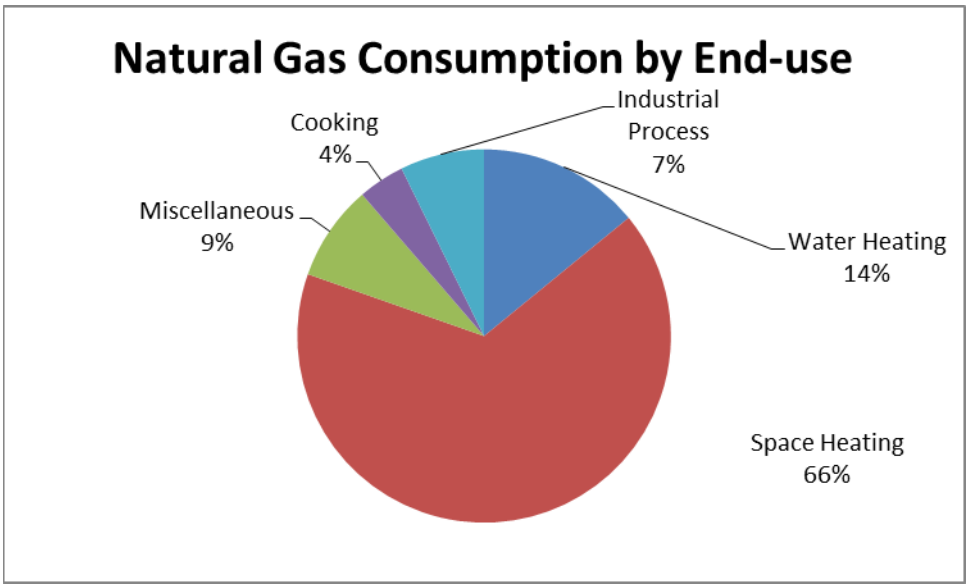

Figure 24: C&I Natural Gas Consumption by End-use[30]

Table 7: C&I Natural Gas Consumption[31]

Natural Gas (therms) 2010	All Building Types	Percent	Per Employee
Water Heating	5,174,936	14%	42
Space Heating	24,361,240	66%	196
Miscellaneous	3,051,182	8%	25
Cooking	1,480,994	4%	12
Industrial Process	2,677,504	7%	22
Total	**36,745,856**		

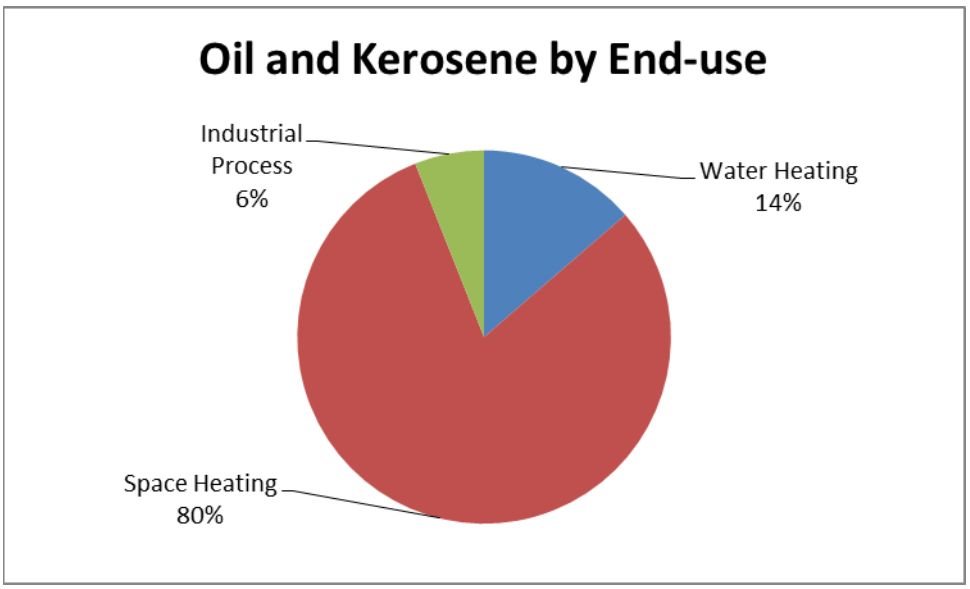

Figure 25: C&I Oil and Kerosene by End-use[32]

[31] Ibid..

Table 8: C&I Oil and Kerosene by End –use[33]

Oil & Kerosene (gallons) 2009	All Building Types	Percent	Per Employee
Water Heating	574,065	14%	5
Space Heating	3,378,148	80%	27
Industrial Process	253,078	6%	2
Total	**4,205,292**		

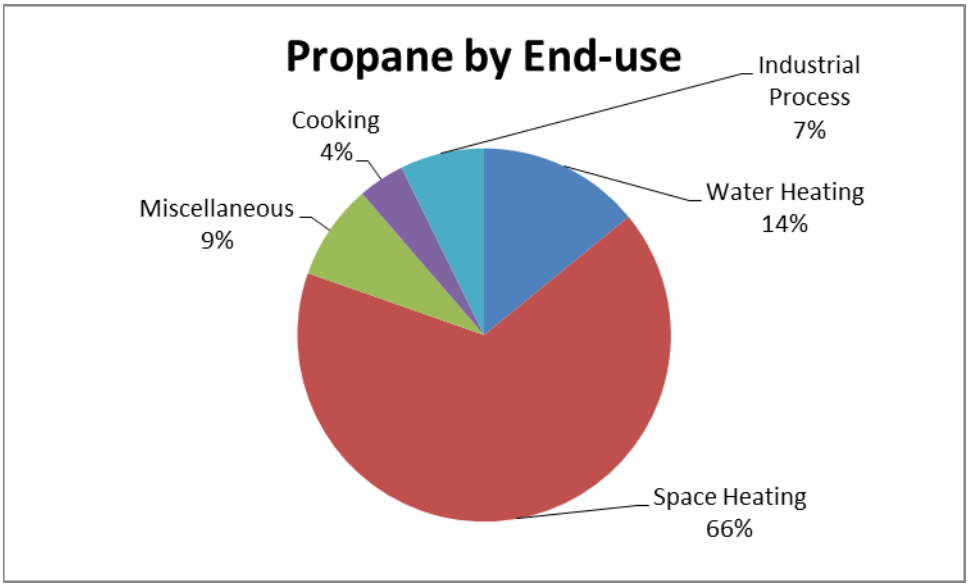

Figure 26: C&I Propane by end-use[34]

Table 9: C&I Propane by End-use[35]

Propane (gallons) 2009	All Building Types	Percent	Per Employee
Water Heating	69,185	14%	0.6
Space Heating	325,693	66%	2.6
Miscellaneous	40,792	8%	0.3
Cooking	19,800	4%	0.2
Industrial Process	35,796	7%	0.3
Total	**491,266**		

Town Level C&I data

This section has C&I data at the town level for electricity and natural gas. This is data that came from Efficiency Vermont and Vermont Gas. Non-transportation petroleum fuels (propane, oil, kerosene) and wood are not included in the tables because of the lack of available data to assign those fuels at the town level. For the residential sector, there are many valid assumptions that can be made about the housing stock to estimate fossil fuel use down to the town level. For commercial and industrial, this is

[32] Ibid..
[33] Ibid.
[34] Ibid..
[35] Ibid.

not the case. As discussed earlier, energy use at commercial and industrial buildings varies widely, preventing valid assumptions to disaggregate the data.

Table 10: Electric Use per Town 2009[36]

Chittenden County Cities and Towns	2009 Commercial & Industrial Electricity (MWh)
BOLTON	2,767,796
BUELS GORE	0
BURLINGTON	261,050,319
CHARLOTTE	3,012,041
COLCHESTER	80,126,375
ESSEX	37,461,060
ESSEX JUNCTION	28,075,265
HINESBURG	7,256,471
HUNTINGTON	594,277
JERICHO	5,702,759
MILTON	32,025,718
RICHMOND	5,385,400
SHELBURNE	25,780,694
SOUTH BURLINGTON	174,124,180
ST. GEORGE	466,903
UNDERHILL	1,234,136
WESTFORD	609,653
WILLISTON	84,945,422
WINOOSKI	25,817,970
Total	**775,969,536**

Table 11: Chittenden County Commercial & Industrial Natural Gas (therms)[37]

Chittenden County Cities and Towns	2010 Commercial & Industrial Natural Gas (therms)
BOLTON	-
BUELS GORE	-
BURLINGTON	13,570,466
CHARLOTTE	-
COLCHESTER	3,529,622
ESSEX & ESSEX JUNCTION	8,514,313
HINESBURG	33,408
HUNTINGTON	-
JERICHO	44,175
MILTON	675,469
RICHMOND	-
SHELBURNE	667,962
SOUTH BURLINGTON	5,618,933

[36] http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx
[37] Data from VGS

ST. GEORGE	-
UNDERHILL	1,902
WESTFORD	-
WILLISTON	3,161,143
WINOOSKI	928,463
Total	36,745,856

Transportation

Chittenden County transportation data is publicly available through several sources, among them the Chittenden County Regional Planning Commission/ CCMPO maintains an extensive library of reports and databases relating to transportation in Chittenden County; the Transportation Research Center at the University of Vermont also makes available a number of research reports pertaining to transportation in Chittenden County; the National Household Travel Survey provides national data on travel behavior, allowing for the analysis of daily travel by all modes. A separate ECOS report focusing on transportation provides an analysis of transportation for Chittenden County. This ECOS Energy report only evaluates transportation metrics that relate to energy consumption for the transportation sector and therefore will only focus on energy-related metrics.

Several metrics relating to transportation are important to consider, as they provide useful indicators: total number of trips (all modes), Person miles of travel (equivalent to accounting for Vehicle Miles Traveled (VMT) and vehicle occupancy), and vehicle fuel efficiency. Land use patterns are also very important in determining the distance that residents and commercial vehicles need to travel; land use is discussed in detail in another ECOS report. Other indicators representing the availability of other transportation options should also be taken into account (e.g. miles of sidewalk and bike path in relation to miles of roads, pedestrian and biker safety, public transportation ridership).

Vehicle Miles Traveled (VMT) is the total number of miles driven by all vehicles within a given time period and geographic area. Vehicle Miles Traveled directly affects gas consumption, emissions, and traffic patterns and is a common measure of roadway use. VMT is not a direct estimate of total personal travel since it does not account for vehicle occupancy (a discussion of vehicle occupancy can be found in the 2009 Vermont Transportation Energy Report). VMT is a major factor affecting Vermont's transportation energy use. Reducing VMT would clearly reduce energy use, but alternatives for travel, especially in a rural state, may be limited.[38]

Annual VMT and annual number of trips for Chittenden County (by trip type) are presented in a table below. External trips are much longer than internal trips, so while they are about 11% of the person trips, they generate about 40% of the VMT in the county (not to mention the additional VMT outside

[38] VTER TRC 11-007, Sears & Glitman, page 10.

Chittenden County not included in this calculation). Work commute trips inside the county also tend to be longer (Table 12).[39]

Table 12: Vehicle Miles Traveled in Chittenden County[40]

Trip Type	2005 Annual VMT Estimate (millions)	Percent of Total Chittenden County VMT	Number of Trips	Percent of Total Trips
Home Based Work (HBW)	166	12%	77,800	10%
Home Based Other (HBO)	251	18%	253,600	33%
Non home Based (NHB)	181	13%	232,400	30%
Light Commercial, 4-tires (L_Comm)	172	12%	101,400	13%
Medium Commercial, 6-tires (M_Comm)	23	2%	12,500	2%
Heavy Commercial 6+ tires (H_Comm)	6	0%	3,000	0.4%
Internal to External (IX)	207	15%	33,000	4%
External to Internal (XI)	371	26%	58,700	8%
External to External (XX)	38	3%	1,800	0.2%
Total	**1,415**	**100%**	**774,200**	**100%**

Overall 92% of trucks (including pickups) use gasoline, 8% use diesel, and a small minority use propane and other fuels[41]; a large majority of cars use gasoline. Therefore the majority of fuel consumption in the county is in effect gasoline. In addition to traditional fuels, a few institutions in Chittenden County use compressed natural gas for their fleets, such as the University of Vermont (buses), and Casella Waste Management CNG (waste haulers), for example. Casella recently installed a natural gas fuelling station at their Williston facility.

In the future, electric vehicles (EV) may come to play a more important role in transportation. This additional electric load would need to be factored into any forecast of electricity use. To forecast the rate of adoption of EV, one could use the assumption that hybrid vehicle owners will be the early adopters of EV. Rate of hybrid vehicle adoption (currently 1.5% of registered vehicles in Chittenden County), used as a proxy for identifying early adopters, would allow for an initial forecast of the impacts of EV on electric load growth and decline of gasoline/diesel consumption. In 2010, there were slightly over 6,300 hybrids registered in the whole state (~1,500 were sold in 2009, ~30,000 new vehicles in total were registered in Vermont). In 2010 hybrids vehicles represented about 1.5% of registered vehicles in Chittenden County.[42]

[40] Base year trip Production model: CCRPC (formerly CCMPO).
[41] Census data, 2002 Economic Census, Vehicle Inventory and Use Survey, issued September 2004 http://www.census.gov/prod/ec02/ec02tv-vt.pdf
[42] UVM TRC Report #11-007, Vermont Transportation Energy Report, Sears & Glitman

Vehicle fuel efficiency varies by Town in Vermont, with vehicles in Chittenden County towns having generally better fuel efficiency than many Vermont Towns (Figure 27 and Figure 28). Differences between towns may be related to several factors including the urban or rural nature of each town, the proportion light vehicles vs. heavier trucks (for farming, forestry, landscaping, building trades, etc.), demographic characteristics (e.g. income), etc.

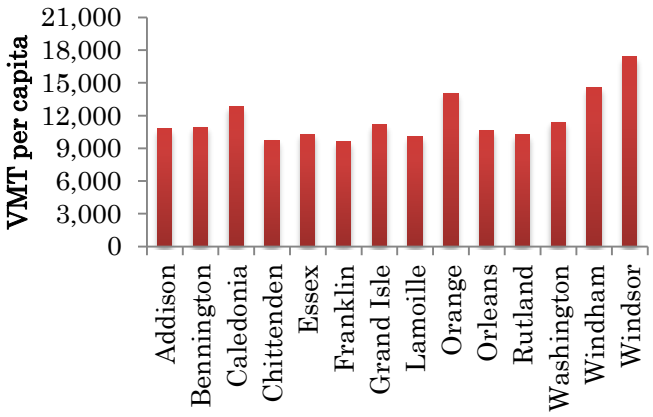

Figure 27: Figure 3-5. VMT by Vermont County, Scaled to Population, 2009[43]

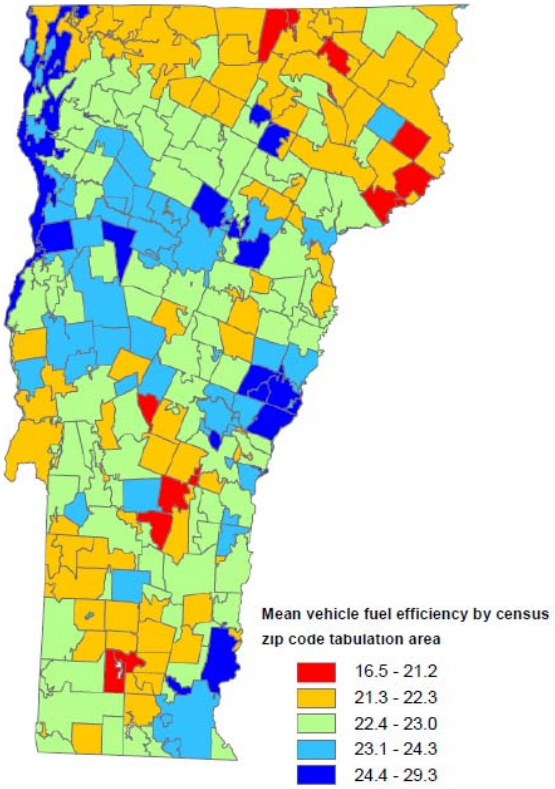

Figure 28: Vehicle Efficiency in Vermont (blue is higher efficiency, red is lower efficiency)[44]

[43] VT TER at 13 UVM TRC 10-017

[44] UVM TRC Report #11-007, Vermont Transportation Energy Report, Sears & Glitman, Data source: VT DMV

Fuel efficiency of commercial vehicles (trucks) varies greatly by vehicle type (Figure 29 and Figure 30). Changes in Chittenden County's economy may affect the type and number of vehicles used for business, therefore affecting the overall average county's vehicle efficiency and fuel consumption.

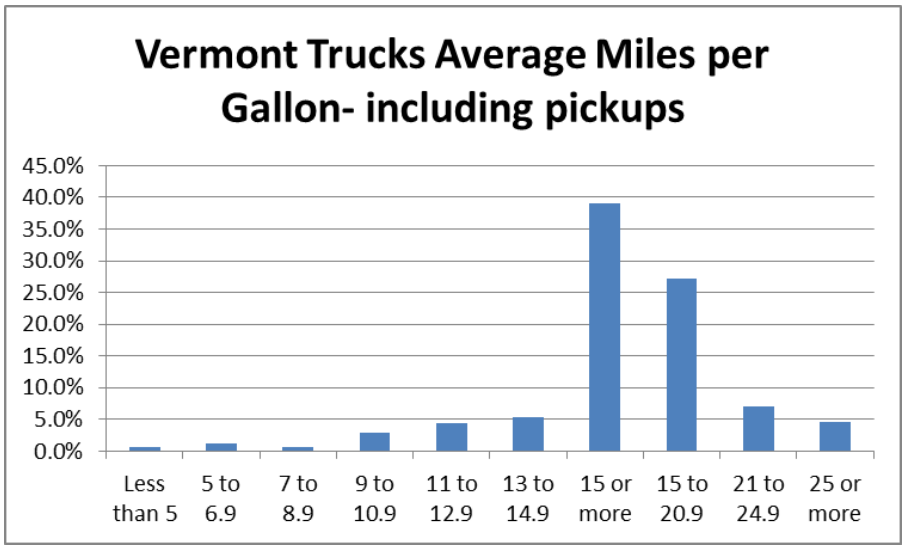

Figure 29: All trucks fuel efficiency[45]

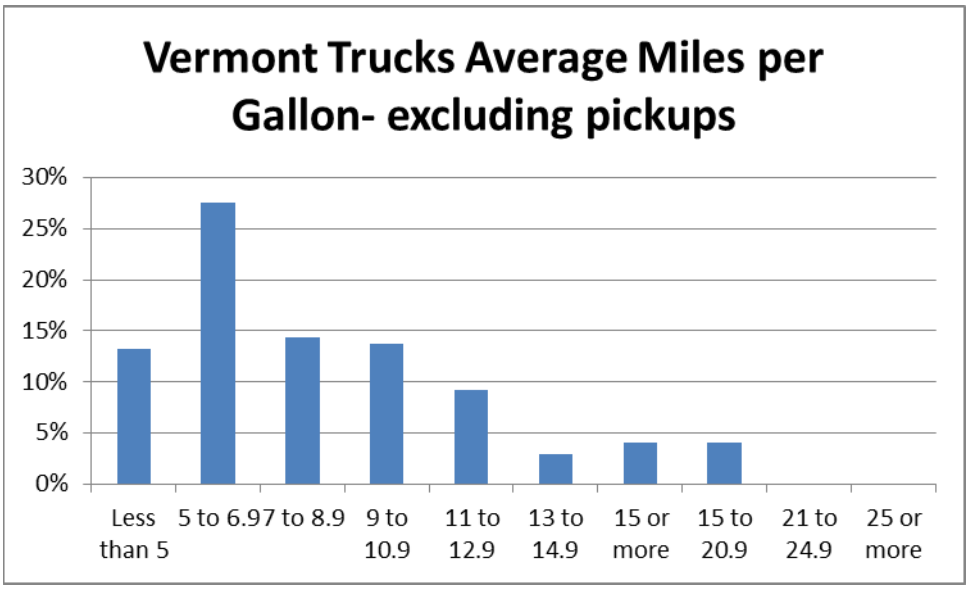

Figure 30: Non-pickup truck fuel efficiency[46]

[45] Data source: VTrans HPMS Data, Chittenden County VTrans Vehicle Miles of Travel (VMT) History, CCMPO 2009,

[46] CAFÉ fuel economy standards: average gas mileage of new cars sold from 1978 to 2010, **Commercial gas mileage**: 2002 Census data: http://www.census.gov/prod/ec02/ec02tv-vt.pdf

The Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) are now jointly managing the Corporate Average Fuel Economy (CAFE) standards for new vehicles (http://www.nhtsa.gov/fuel-economy). The Obama administration finalized rules in April 2010 running from model year 2012-2016 which would bring car and light truck fuel economy from 29.2 mpg in 2010 to 34.1 mpg in 2016. On Nov 16, 2011 EPA and NHTSA issued a joint notice of proposed rule-making in November with increased CAFE standards from 2017-2025. These are awaiting publication in the federal register. If these become final, then combined car and light truck fuel economy will go from 34.1 mpg in 2016 to 49.6 mpg in 2025.[47] As vehicle fuel efficiency plays an important role in total fuel consumption, changes to fuel efficiency standards have the potential to greatly reduce transportation fuel consumption in Chittenden County. Fuel efficiency standards have not improved between the 1980s and 2004, and stricter fuel efficiency standards would be an important step forward from an energy point of view.

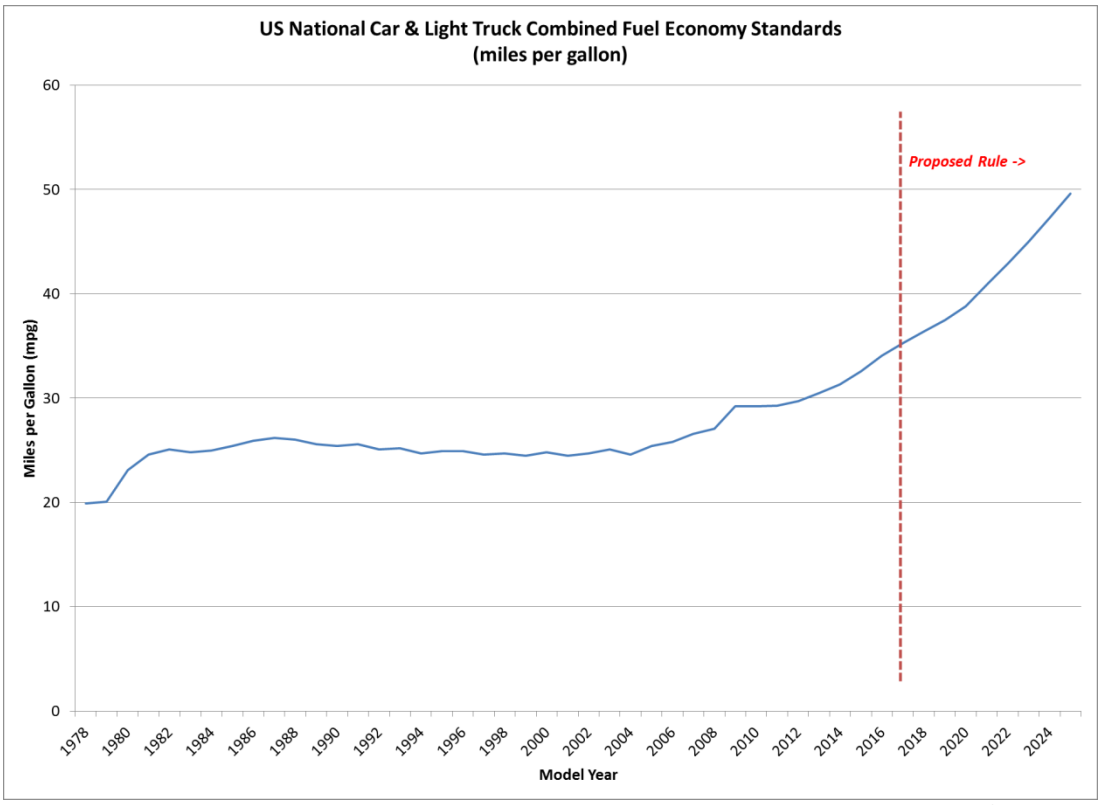

Figure 31: Fuel Efficiency Standards (CAFE) Historical Trends and Proposed Rule[48]

Using average fuel efficiency and annual VMT in Chittenden County, the UVM Transportation Research Center estimated transportation fuel consumption in Vermont's counties. The analysis placed Chittenden County as the largest consumer of total gasoline of all Vermont Counties, but with an overall lower per capita gasoline consumption than other Vermont counties (Table 13).[49]

[47] David Roberts, CCRPC/CCMPO personal communication
[48] http://www.census.gov/prod/ec02/ec02tv-vt.pdf
[49] UVM TRC Report #11-007, Vermont Transportation Energy Report, Sears & Glitman

Table 13: VMT, Vehicle Efficiency, and Gasoline Consumption by Vermont County

County	Total VMT (in million miles)	Mean Vehicle Efficiency (mpg)	Total estimated gasoline use (million gallons)	Per capita estimated gasoline use (gallons)	Per capita estimated gasoline use (MMBTU) [50]	Percent of total statewide VMT	Percent of statewide total estimated gasoline use
Addison	399	23.3	17,116,435	466	58	6%	5%
Bennington	398	22.5	17,693,899	486	61	6%	6%
Caledonia	388	22.5	17,225,179	569	71	5%	5%
Chittenden	**1,486**	**23.2**	**64,035,444**	**420**	53	**21%**	**20%**
Essex	66	21.6	3,052,044	477	60	1%	1%
Franklin	462	22.3	20,712,834	430	54	6%	7%
Grand Isle	85	22.7	3,755,879	491	61	1%	1%
Lamoille	262	22.4	11,701,978	451	56	4%	4%
Orange	406	23.1	17,557,238	608	76	6%	6%
Orleans	289	21.9	13,207,669	484	61	4%	4%
Rutland	647	22.4	28,882,566	458	57	9%	9%
Washington	670	23.3	28,742,319	490	61	9%	9%
Windham	634	23.2	27,331,488	629	79	9%	9%
Windsor	985	23	42,844,204	758	95	14%	14%

The distance that Chittenden County residents have to travel to reach their destinations has a major effect on VMT and total fuel consumption. Mean commute length in Chittenden County is 9.1 miles, which is less than the average for many Vermont counties and partially explains the County's lower per capita fuel consumption.

Table 14: Mean Commute Length by County[51]

County	Mean Commute Length (miles)	% VT population
Addison	14.4	5.9
Bennington	8.2	5.9
Caledonia	9.3	4.9
Chittenden	**9.1**	**24.5**
Essex	10.7	1.0
Franklin	12.2	7.7
Grand Isle	15.9	1.2

[50] http://www.spe.org/industry/docs/UnitConversion.pdf assuming conventional gasoline: 5.253 MMBTU/barrel, 1 gallon = 0.0238095 barrel

[51] VT TER at 15 UVM TRC 10-017

Lamoille	14.9	4.2
Orange	11.6	4.6
Orleans	10.9	4.4
Rutland	7.2	10.1
Washington	8.8	9.4
Windham	7.3	7.0
Windsor	9.6	9.1

Park and Ride facilities provide an opportunity for travelers to use public transportation or maximize vehicle efficiency. Trends in utilization of Park and Ride facilities are indicators of changes in vehicle occupancy factors.

Table 15: Chittenden County Park and Ride Parking Lot Capacity[52]

	Percent Capacity			
Facility	2007	2008	2009	2010
Charlotte	--	--	53%	--
Colchester	44%	46%	--	29%
Charlotte	--	--	53%	--
Colchester	44%	46%	--	29%
Richmond	103%	143%	--	143%

Public transportation provides an alternative to single vehicle occupancy transportation or carpooling; bus ridership has increased by 22% in Chittenden County between 2006 and 2010 (Table 16). Passenger train ridership in Chittenden County is available on the Vermonter rail line (Washington, D.C. - St Albans), and is used exclusively for trips into and out of Chittenden County (there is only one stop in Chittenden County). Passenger rail transit in Vermont has increased by 50%[53] overall between 2006 and 2010, and is it likely that boarding and alighting in Chittenden County also increased.

Table 16: Bus Ridership 2006-2010[54]

Transit Provider	2006	2007	2008	2009	2010	Percent Change 2006-2010
Chittenden County Transportation Authority	2,009,371	2,120,451	2,206,828	2,514,562	2,455,731	22%

The number of miles of sidewalk and bike path is an indication of the availability of access to non-fossil fuel transportation options. This data is available at the Town level (Table 17) and shows variable level of pedestrian and biking infrastructure in different towns, which could be tracked as an indicator of progress towards providing alternative transportation options.

[52] UVM TRC Report #11-007, Vermont Transportation Energy Report, Sears & Glitman
[53] Ibid..
[54] Ibid..

Table 17: Bicycling and Pedestrian Facilities in Chittenden County[55]

Town	On road (miles)	Sidewalk (miles)	Shared Use (miles)	Total Roads (miles)*	% Bike/ Pedestrian Facilities of Total Road Miles
Bolton	3.9	.	.	31.9	12%
Buels Gore	.	.	.	3.2	0%
Burlington	21.9	133.0	13.4	95.1	177%
Charlotte	10.2		0.8	80.8	14%
Colchester	14.5	31.7	7.8	110.7	49%
Essex	1.3	74.7	3.3	132.54	60%
Hinesburg	.	2.5	0.3	60.88	5%
Huntington	.	.	.	43.96	0%
Jericho	.	1.8	.	68.24	3%
Milton	3.7	19.61	.	118.737	20%
Richmond	6.69	2.17	0.5	62.1	15%
Shelburne	9	10.02	2.9	56.9	38%
South Burlington	5.8	43.3	22.4	94.9	75%
St. George	.	.	.	5.3	0%
Underhill	.	0.3	.	57.4	1%
Westford	.	.	.	48.71	0%
Williston	5.8	18.4	4.2	89.02	32%
Winooski	0.1	17.4	.	18.8	93%
Grand Total	**82.8**	**355.0**	**55.8**	**1,179.3**	**42%**

On the commercial side, merchandise is typically transported within, in, and out of Chittenden County primarily by truck and rail. Evaluating freight transportation by air for an area as small as Chittenden County is difficult due to the small proportion of a trip that can be attributed to the County itself. The value of such an analysis is also arguable; therefore, the following section only reviews truck and rail commercial transportation. In many cases, data was only available at the state level, wherever this is the case it is clearly indicated in the chart or table title.

Overall the CCMPO freight study indicated that the majority of freight is transported by truck rather than train (Table 18). [56] The merchandise transported by rail rather than truck tend to be heavy, non-perishable items, such as minerals, clay, concrete, glass and stone, and chemicals (Table 19). Any

[55] UVM TRC Report #11-007, Vermont Transportation Energy Report, Sears & Glitman

comprehensive sustainability plan to reduce commercial transportation energy use will have to incorporate the needs of different industries and the transportation means that they currently employ into the plan.

Table 18: Freight transportation in Chittenden County

Mode Share for all freight (percent by weight)	Into, out of, and internal	Into	Out of	Number of Freight Trips Annually (into, out of, and internal
Truck	91.4%	87.7%	99.6%	42,668,500
Rail	5.7%	8.2%	0.2%	
Air	0.1%	0.0%	0.2%	
Water	0.0%	0.1%	0.0%	
Other	2.8%	4.1%	0.1%	

Table 19: Merchandise transported by truck and rail

Top Commodities in Chittenden County (into, out of, and within)	Truck	Rail
Primary Metal Products	3%	0%
Fabricated Metal Products	3%	
Electrical Equipment	4%	
Petroleum and Coal Products	4%	5%
Chemicals or Allied Products	5%	7%
Lumber or Wood Products	11%	1%
Other	9%	0%
Food or Kindred Products	23%	3%
Warehouse, Distribution, Intermodal	15%	
Clay, Concrete, Glass or Stone	12%	11%
Pulp, Paper, or Allied Products	11%	3%
Crude Petroleum or Natural Gas		3%
Transportation Equipment		1%
Non-metallic Minerals		67%

The type of merchandise transported by truck in Vermont is presented in Figure 32; a similar breakdown for Chittenden County was not available but may share many similarities.

[56] Chittenden County Regional Freight Study ~ Final Report, Prepared for: Chittenden County Metropolitan Planning Organization, Prepared by: Cambridge Systematics, Inc., August 2001, http://www.ccmpo.us/library/freight/index.php?rept=2

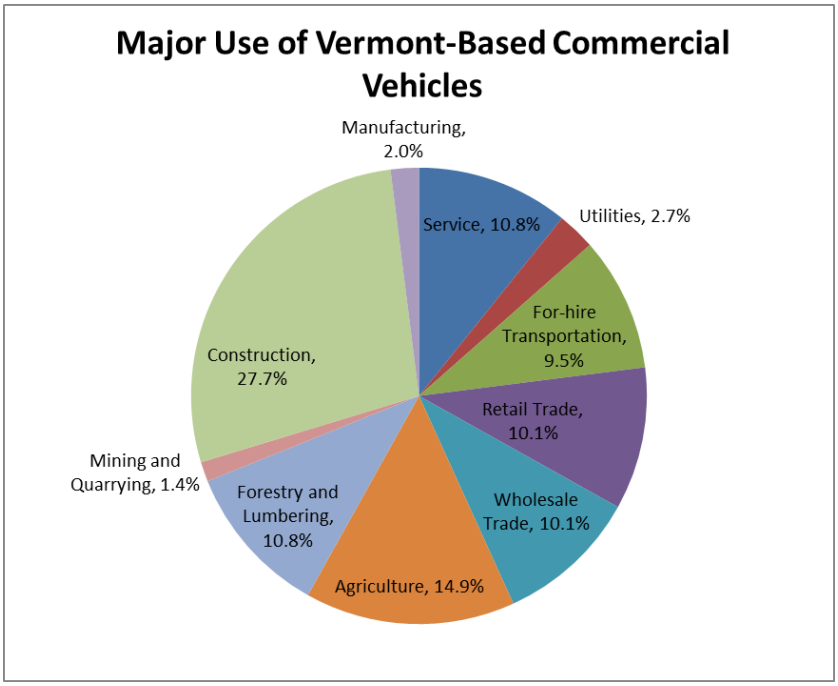

Figure 32: Type of merchandise transported in Vermont

Transportation accounts for the highest share of overall energy use in Vermont (33.7%) [57] higher than the national average. Chittenden County being more densely populated than the rest of Vermont is likely to have a smaller share of its energy consumption originating from transportation. However, the share of transportation in the overall energy use in the county is still very likely to be large and should be addressed in sustainability plans.

Energy Supply

Chittenden County imports all fossil fuel resources. Natural gas is supplied by Vermont Gas through its network of pipelines and supply channels. Other fossil fuels arrive to Vermont homes and businesses from truck deliveries. Consumers and businesses purchase natural gas from Vermont Gas and all other fossil fuels are purchased through fuel distributors whose prices are unregulated.

With respect to electricity, determining exactly where an electron comes from and exactly where it is consumed is a tricky science and it is difficult to determine if the electricity produced locally is used locally, especially for utility owned generation. Therefore we separate the issues of power plants that physically supply the local grid and the power plants that make up the power supply portfolio of the local utilities. This section discusses the power supply portfolios of the utilities in Chittenden County.

Electricity is supplied to Chittenden County by four electric utilities: Burlington Electric Department (BED), Central Vermont Public Service (CVPS), Green Mountain Power (GMP) and Vermont Electric Coop (VEC). Each utility purchases electricity from a variety of power producers through short and long term

[57] State Energy Plan
http://www.vtenergyplan.vermont.gov/sites/cep/files/Vol%202%20Public%20Review%20Draft%202011%20CEP.pdf

contractual agreements. The power generators use a variety of fuel sources to create the electricity. In this section we are using the following categories to describe the fuel sources:

- Hydroelectric – This category includes both large and small scale hydroelectric plants.
- Nuclear – Vermont Yankee supplies nuclear power to the state of Vermont
- Wood – McNeil is the primary source of wood power
- Wind – are variety of wind turbines throughout the state
- Oil and natural gas – electric plants using oil and natural gas
- Other renewables – includes landfill gas, CVPS cow power
- Market Purchases – this category represents a variety of suppliers and fuel sources

When looking at the state level, the source of electricity is from a variety of sources.

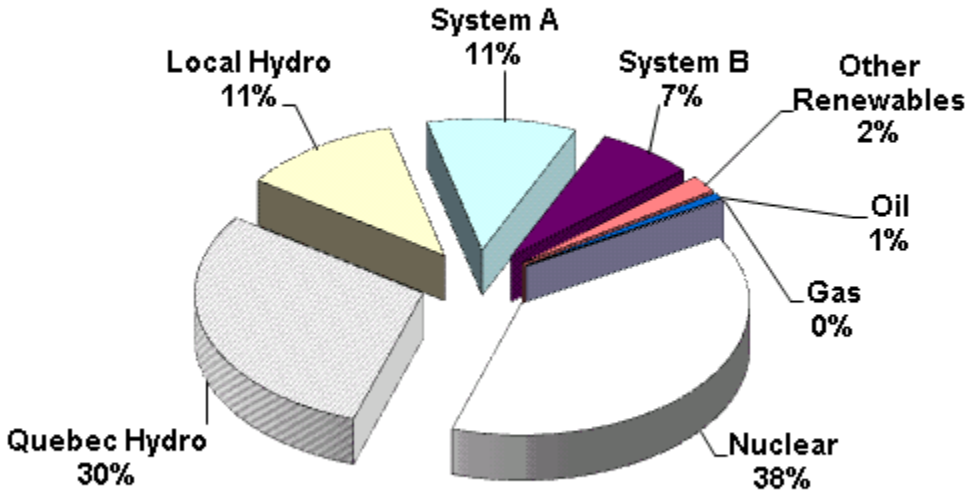

Figure 33: Vermont Electricity Generation[58]

The four utilities serving Chittenden County each have a different mix of fuels from which their electricity is generated. The percent distributions are shown in Figure 34 through Figure 37.

[58] System A is market purchases of energy by Vermont utilities. System B is energy produced by Vermont renewable facilities where the renewable energy certificates (RECs) have been sold to third parties who now own and claim those environmental attributes http://www.vtenergyplan.vermont.gov/sites/cep/files/2011%20CEP_Volume%202.pdf

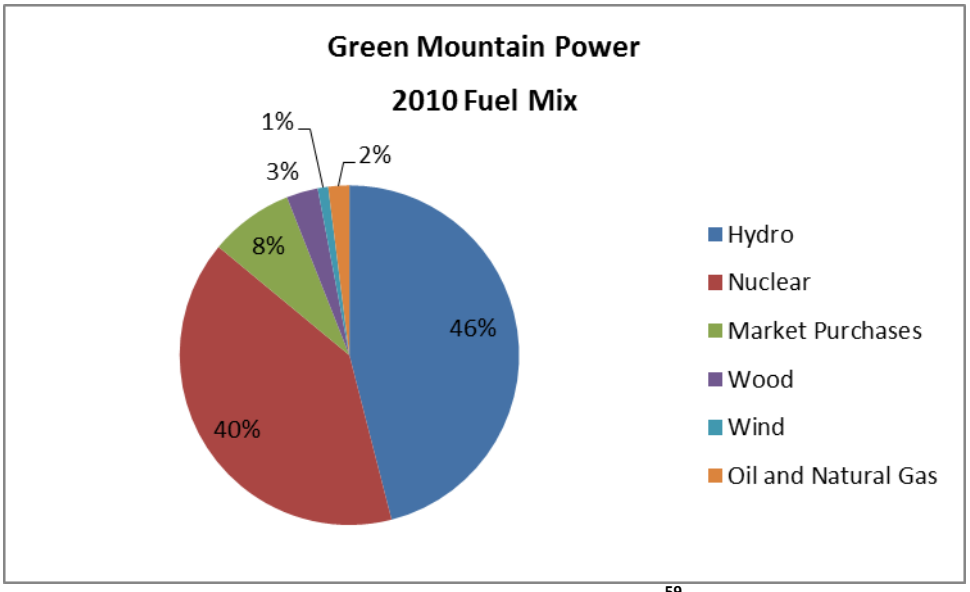

Figure 34: Green Mountain Power[59]

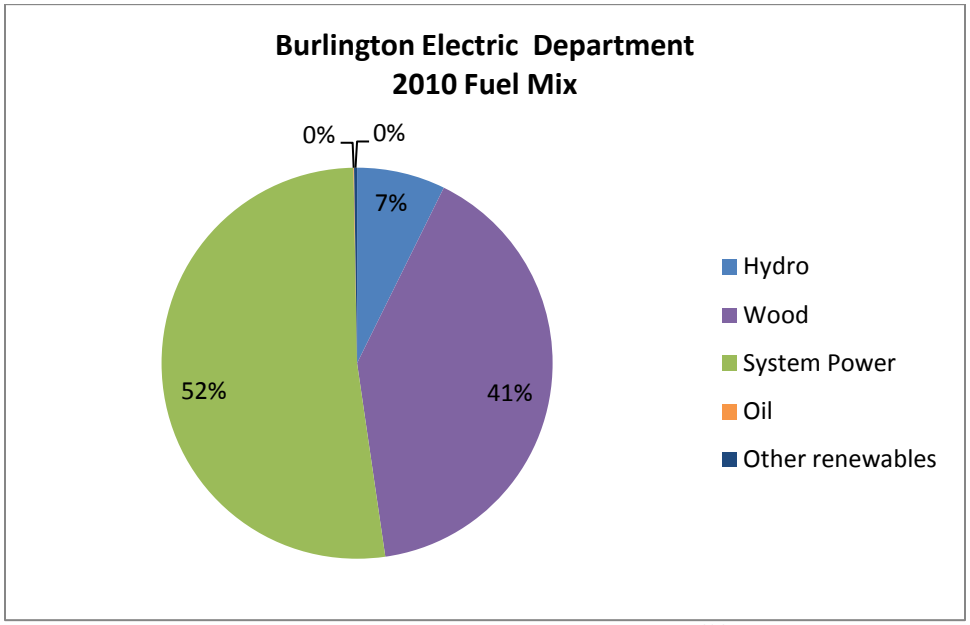

Figure 35: Burlington Electric Department[60][61]

[59] http://www.greenmountainpower.com/about/commitment/sustainability-report/footprint.html#_Toc179788483

[60] https://www.burlingtonelectric.com/page.php?pid=128&name=BED%27s%20Power%20Supply

[61] "System Power" is defined as a purchase composed of a mix of resources with the fuel and emissions characteristics of the ISO New England "residual mix" those resources left after all compliance and voluntary retirement of renewable sources is complete.

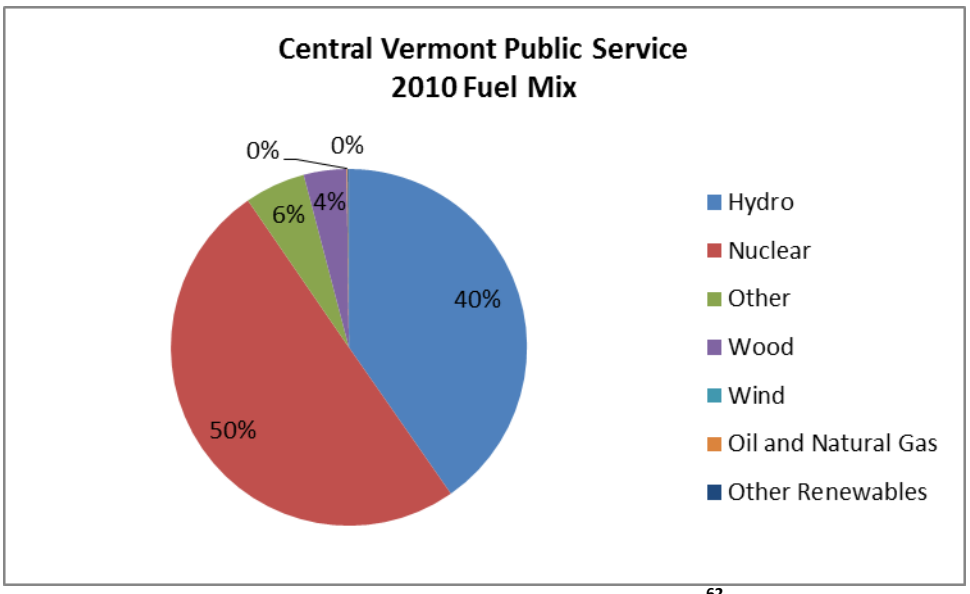

Figure 36: Central Vermont Public Service[62]

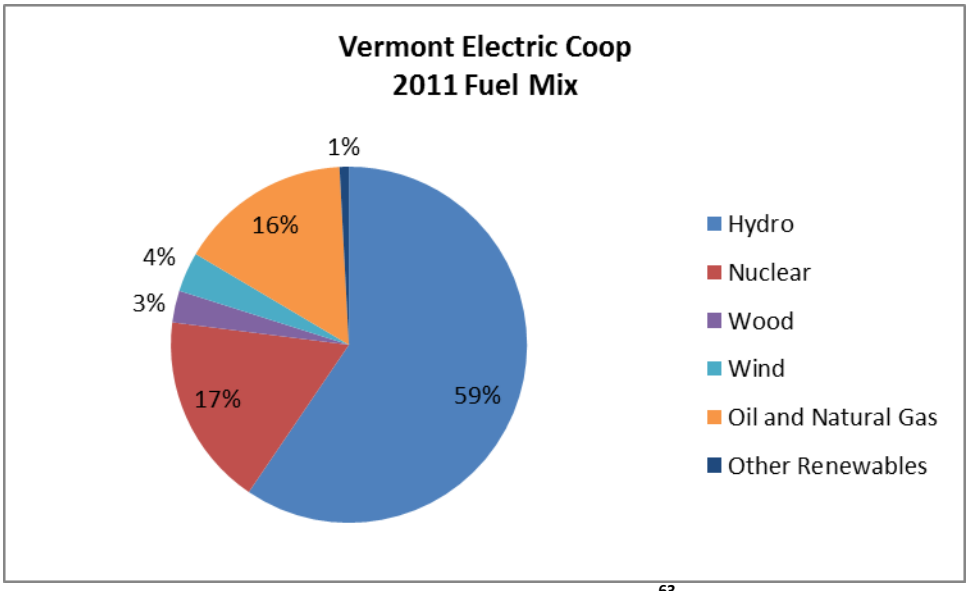

Figure 37: Vermont Electric Coop[63]

Very little power is generated by oil and natural gas fired plants. VEC has the highest percent of hydroelectric and the highest percent of oil and natural gas. BED has the highest percent of wood and no nuclear. GMP has the second highest percent of hydroelectric and CVPS has the highest percent of nuclear.

Renewable Electricity Generation Located in Chittenden County

Chittenden County has several locations generating electricity which are owned by utilities, municipalities and private parties.

[62] http://www.cvps.com/ProgramsServices/EnergySources.aspx
[63] http://www.vermontelectric.coop/energy-portfolio

Many private and municipally owned systems (e.g. wind, solar and farm methane) in Chittenden County tie into the grid through net metering which allows a utility customer to own and operate a small generator on the customer side of the meter. Net metered systems generate electricity that is used by the customer and excess is fed onto the grid.

Chittenden County has the following private, municipal and utility owned systems generating electricity. The tables show the capacity of the system, not the actual electricity produced annually.

Table 20: Private Renewable Systems[64]

	Capacity	Number of Sites
Solar PV (kW)	4977	320
Wind (kW)	486	26
Methane Digesters (kW)	84	3

Table 21: Municipal Renewable Systems[65]

	Capacity	Number of Sites
Solar PV (kW)	972	18
Wind (kW)	5	2

Table 22: Utility Owned Renewable Systems[66]

	Capacity	Number of Sites
Solar PV (kW)	152	2
Wood (MW)	50	1
Hydro (kW)	35,800	6

The McNeil Generating station, which is the one wood fired plant listed in Table **22** is located in the Interval section of Burlington and uses a combination of wood chips and waste wood from sawmills to generate electricity. The plant is jointly owned by BED at 50 percent, CVPS at 20 percent, Vermont Public Power Supply Authority at 19 percent and GMP at 11 percent[67]. McNeil generates about 55 megawatt hours annually.

There are six utility owned hydro stations located in Chittenden County. Three are on the Lamoille River and the other three are on the Winooski River. Combined they generate about 152,000 MWh annually.

Thermal energy for heat and hot water is also a way to harness renewable energy. Similarly to the rest of the region, use of wood as the primary heating source has increased by 25-40% in Vermont[68]:

[64] http://www.vtenergyatlas.com/ Personal Communication with Scott Sawyer 10-12-11
[65] Ibid.
[66] Ibid.
[67] https://www.burlingtonelectric.com/page.php?pid=75&name=mcneil
[68] Transforming Wood Heat in America, A Toolkit of Policy Options, July 2011, Alliance for Green Heat

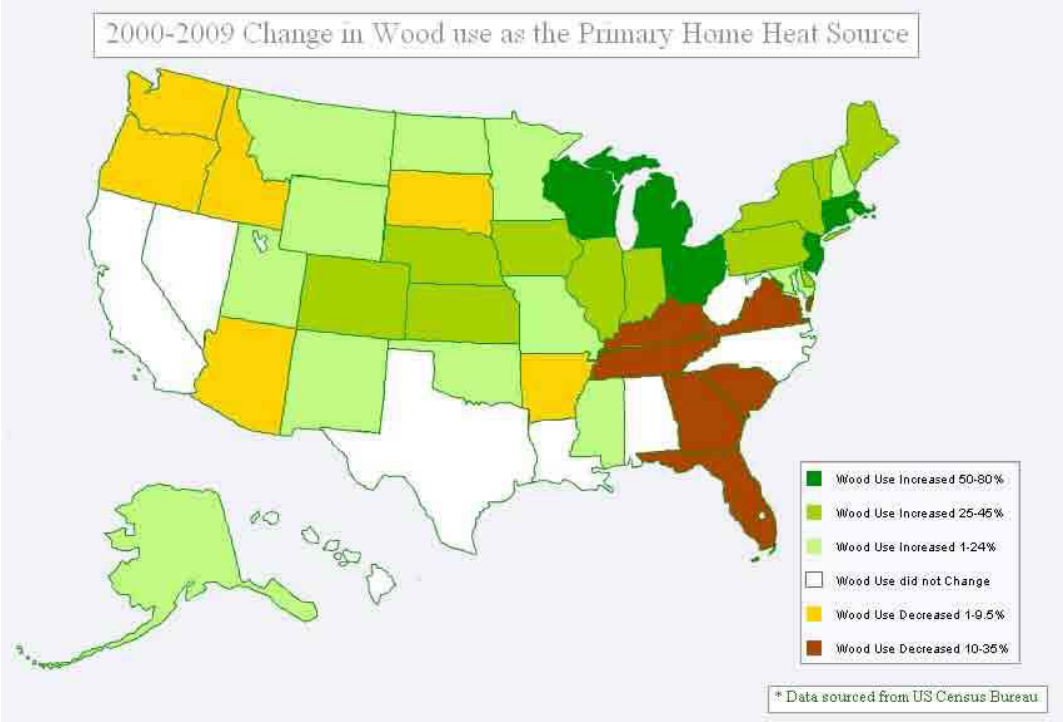

Figure 38: Wood Use for Primary Home Heating[69]

Vermont is the state where the percentage of houses heating with wood as primary heat source is highest[70]:

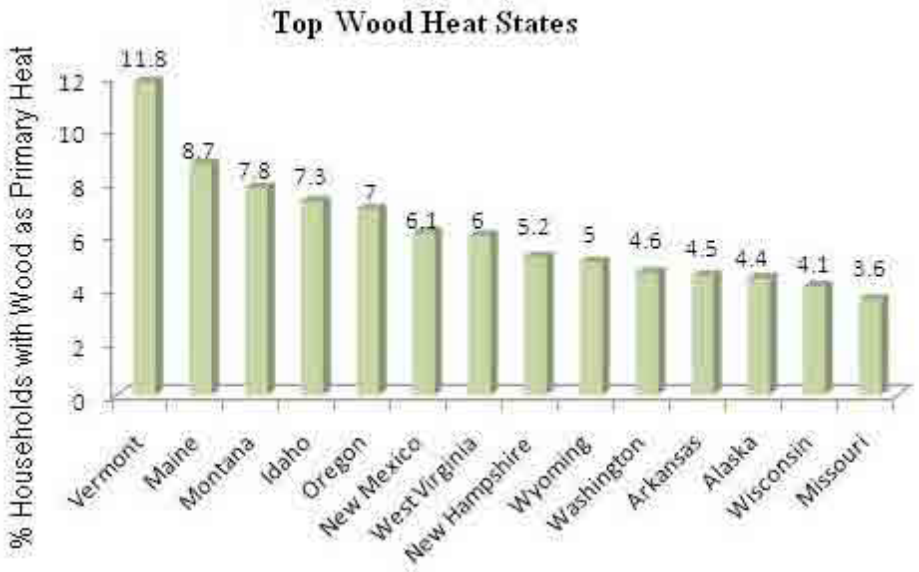

Figure 39 Top Wood Heat States

Chittenden County has solar thermal for domestic hot water and wood heat sites throughout the county. The woody biomass sites are wood chip boilers run by school districts and private parties.

[69] Ibid.
[70] Ibid.

Table 23: Private Solar Thermal[71]

	Capacity	Number of Sites
Solar Thermal (Thousand Btus)	2,975	42

Table 24: Private and Municipal Woody Biomass Thermal

	Capacity	Number of Sites
Municipal Woody Biomass Thermal (Tons of Wood Consumed)	3805	6
Private Woody Biomass Thermal (Tons of Wood Consumed)	200	2

Energy Efficiency

The State of Vermont has a long tradition of supporting efficiency programs. Currently three organizations run programs supporting the installation of high efficiency equipment in the commercial and residential sector Burlington Electric Department, Vermont Gas and Efficiency Vermont. The three programs operate in a collaborative manner and often support join initiatives that save electricity, natural gas, fossil fuels and water. Other benefits include reduced energy bills and reduced capacity requirements. In 2010 alone Efficiency Vermont installations produced over $115 million in total resource benefits[72] to the residents of Vermont[73]

New for Vermont efficiency planning is a process called the Demand Resource Plan (DRP). The DRP is a statewide plan that develops a set 20 year targets for energy reductions and other associated benefits. The first three years of the forecast are the operating targets and goals for the efficiency programs of Burlington Electric, Efficiency Vermont and Vermont Gas. The first three years have more specifics and granularity and generally could be considered more accurate than the years further out on the time scale.

Chittenden County Electric Savings from Efficiency Vermont is shown in Figure 40. The years 2005 to 2009 are actual results and then forecasted out to 2031. The 2005-2009 data is available down to the town level at the Efficiency Vermont web page[74]. The data for 2011 is based on annual goals. The subsequent years 2012 – 2031 are taken from the most recent draft proposal from the statewide DRP process and proportioned down to Chittenden County.

[71] http://www.vtenergyatlas.com/

[72] Total Resource Benefits are the benefits to the rate payer using the avoided cost of energy and the cost of running the programs

[73] Efficiency Vermont 2010 Annual Report
http://www.efficiencyvermont.com/docs/about_efficiency_vermont/annual_reports/2010_Savings_Claim.pdf

[74] http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx

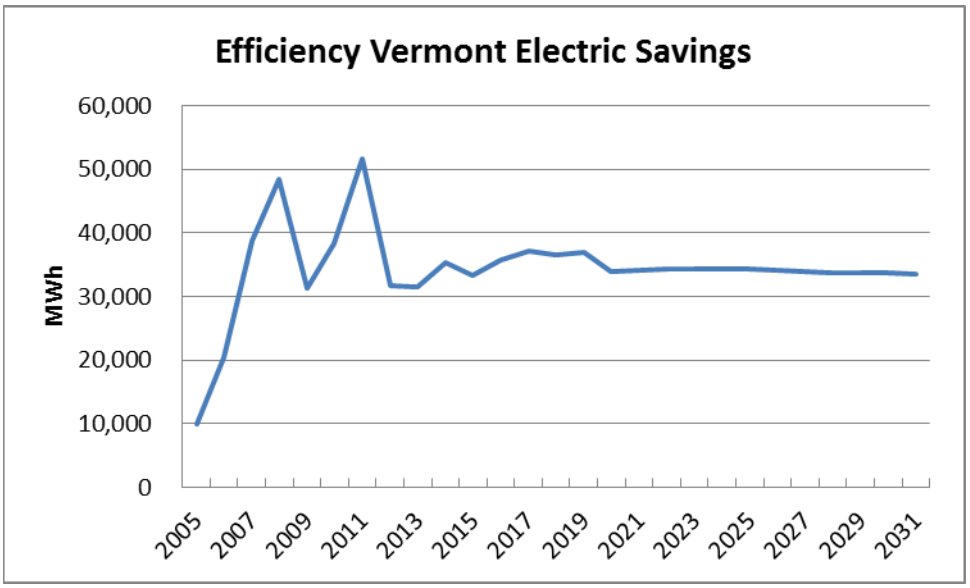

Figure 40: Efficiency Vermont Chittenden County Electric Savings

Figure 41 shows the electric savings as a percent of the retail electric sales in Chittenden County. The data used for 2005 – 2010 is the actual electric savings claimed as compared to the retail electric sales in Vermont. For 2011 – 2031 forecasted electricity sales was compared to forecasted electricity savings**.**

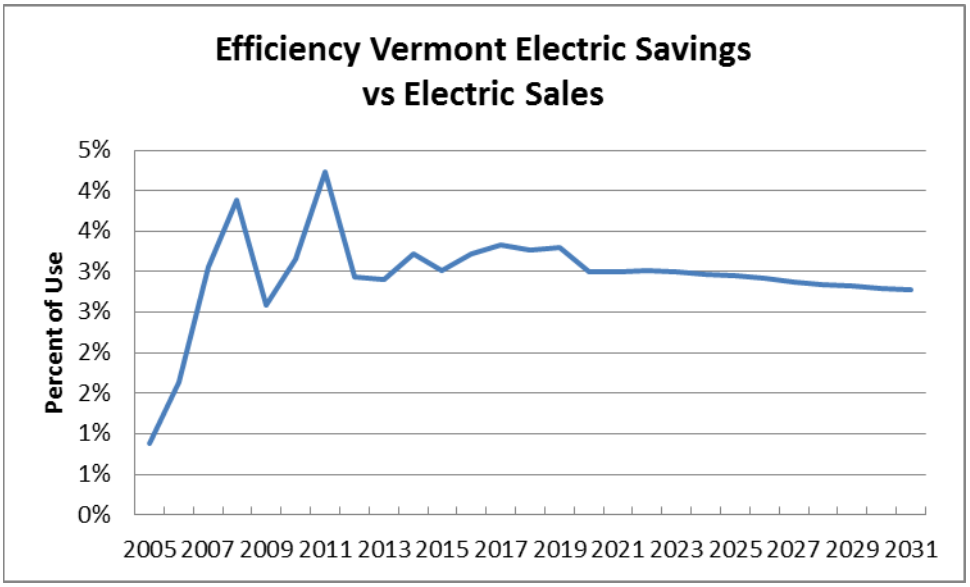

Figure 41: Percent Chittenden County Electric Savings as a Percent of Electric Sales

Burlington Electric Department efficiency program started in 1990 and has invested $15.6 million in programs and incentives over the years. The result of these efforts Burlington customers save over $9.5 million in retail electric costs annually.

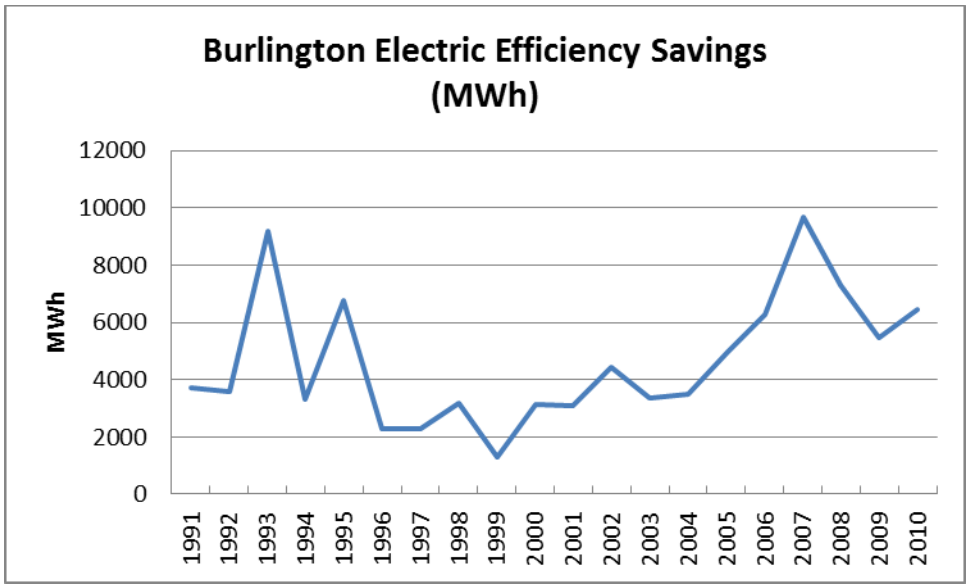

Figure 42: Burlington Electric Department Electric Efficiency Savings[75]

Vermont Gas Systems also has a successful efficiency program that invests about $2 million annually in commercial and residential projects that reduce consumption of natural gas for space and water heating as well as commercial and industrial process.

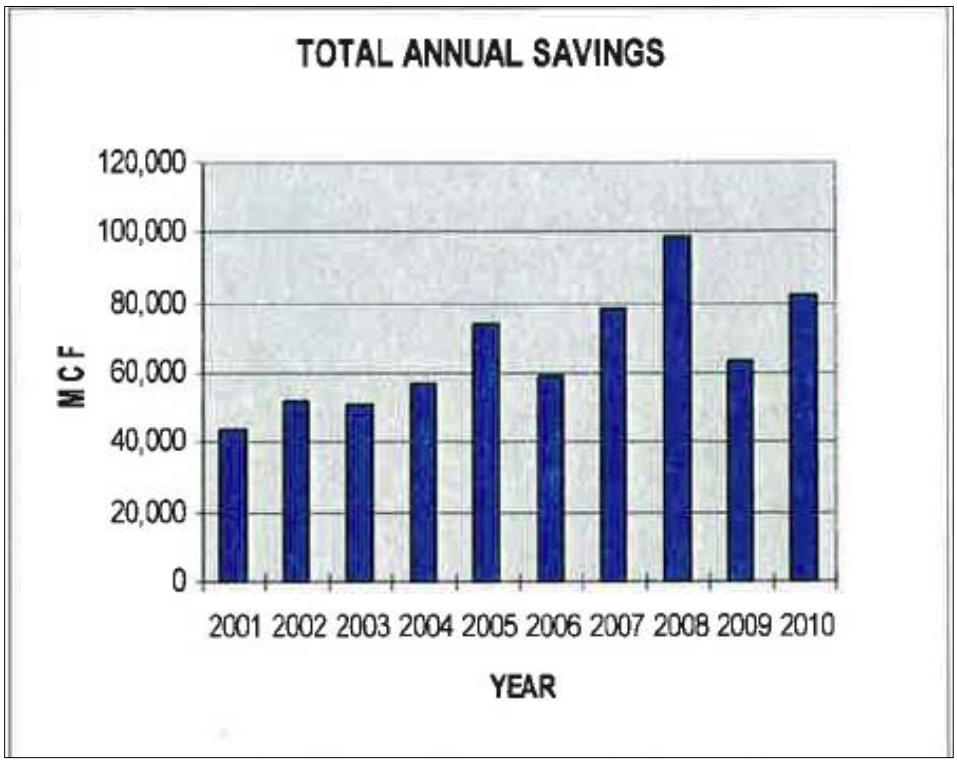

Figure 43: Vermont Gas Efficiency Program Savings

[75] https://www.burlingtonelectric.com/ELBO/assets/energy%20efficiency/2010%20DSM%20Annual%20Report%20Master.pdf

Resources for Municipal Planners

Municipal Planners in Vermont have many resources available to help them pursue reducing energy consumption in their facilities and throughout their city or town.

The Energy Planning Implementation Guidebook for Vermont Communities[76] was developed by the Vermont Natural Resources Council and the Vermont League of Cities and Towns and was completed in April, 2011. This is a very useful "how to" document that maps out, step by step, a process to develop a municipal energy plan and also discusses strategies and resources available to communities to help implement the plan.

Another important document for municipal planners is the Communities Tackling Vermont's Energy Challenges[77] which is a compilation of case studies covering topics including community engagement, efficiency and conservation, renewable energy, transportation and waste reduction. Each chapter of this document has several examples of Vermont communities that planned and implemented innovative projects with the aim of reducing energy consumption. Several of these example projects are in Chittenden County.

Other guidebooks designed to help municipal planners tackle energy planning are also located on the VNRC web page[78] include:

- GUIDE TO MUNICIPAL ENERGY PLANNING, Vermont Department of Public Service, 1993
- EARTHRIGHT INSTITUTE'S GUIDE TO TOWN ENERGY PLANNING IN VERMONT (with Model Town Energy Plan), 1992
- TOWN ENERGY PLANNING: A FRAMEWORK FOR ACTION, Paul Markowitz
- TOWN ENERGY AND CLIMATE ACTION GUIDE, VECAN, 2007

State Policies Supporting Sustainability

Vermont has several distinctive state-level policies and incentives in place that support the development of renewable energy and energy efficiency technologies. In 2010 Vermont ranked highest for electric efficiency program spending per capita[79] and has been ranked within the top ten states by American Council for an Energy Efficient Economy (ACEEE) in their annual State Energy Efficiency Scorecard over the past several years[80]. These policies have established Vermont as a leader nation-wide with a proven record of success in achieving energy savings and progress toward renewable energy installations and power purchases. Regional and town planners can leverage these initiatives in their local long and short term planning activities.

[76] http://www.vnrc.org/energy/resources/energy-planning-implementation-guidebook-for-vt-communities/
[77] Ibid..
[78] http://www.vnrc.org/article/view/21572/1/580/
[79] 2010 State of the Efficiency Program Industry. CEE
http://www.cee1.org/files/2010%20State%20of%20the%20Efficiency%20Program%20Industry.pdf
[80] The 2011 State Energy Efficiency Scorecard. ACEEE
http://www.aceee.org/sites/default/files/publications/researchreports/e115.pd

Energy Efficiency - Efficiency Vermont, Vermont Gas and Burlington Electric Department provide technical support and financial incentives for energy efficiency new construction, equipment purchases and retrofit projects.

- **Over $35 million a year** combined to support energy efficiency activities for electricity, natural gas and unregulated fuels[81]**.**

- **GeoTargeting (GT)** - The objective of GeoTargeting implementation is to determine the extent to which energy efficiency can help defer or delay the capital investment in growth-related electrical infrastructure improvements to transformers, distribution system circuits and feeders projected to require significant upgrades in the next five to ten years.

- **Community Energy Initiatives (CEI**). Efficiency Vermont employs several approaches to work with communities to expand energy efficiency in homes and businesses. Speakers , educational materials and help promoting do-it-yourself energy efficiency measures, direct installation of lighting and water conservation measures, and encouraging greater efficiency investment available to communities and schools

- **Unregulated Fuel Initiative –** Promotes initiatives to help Vermonters reduce heating fossil fuel consumption through weatherization, heating system replacements and Incentives and services for agricultural facilities, including incentives for hot water conservation and water heating efficiency, including heat exchangers to pre-heat water with compressor waste heat .

- **Municipal Street Lighting Program** is designed to help Vermont municipalities upgrade their older, less efficient lighting technologies in street and public spaces with energy-efficient light emitting diode (LED) lighting

Renewable Energy – There are several policies to promote renewables as well as financial incentives and loan programs to facilitate equipment installation.

- **Local Option – Property Tax Exemption** - Vermont allows municipalities to offer an exemption from the municipal real and personal property taxes for certain renewable energy systems including "windmills, facilities for the collection of solar energy or the conversion of organic matter to methane, net-metered systems ... and all component parts thereof including land upon which the facility is located, not to exceed one-half acre."

- **Sustainably Priced Energy Development Program (SPEED)** – The goal of the SPEED program is to promote the development of in-state energy sources which use renewable fuels and provide a standard offer for pricing.

- **The clean energy development fund (CEDF)** – Established in 2005 to promote the development and deployment of cost effective and environmentally sustainable electric power resources offers low interest loans for projects based in Vermont. The CEDF was funded through an MOU with Entergy through 2012.

[81] Ibid..

- **Vermont Small Scale renewable Energy Incentive Programs** offers incentives for solar and wind energy projects. Technical assistance and consumer information on solar and wind as well as a list of solar and wind partner installers is found on the companion site Renewable Energy Resource Center.

- **Corporate tax credit** - Vermont offers a corporate tax credit for equipment that uses solar energy for water heating, process and photovoltaic installed on business properties. The credit is 24% of the Federal Vermont property portion and is in effect from 2011- to 2016.

- **Net Metering** – customer generation allowed to be fed on the grid and credited to customer's next bill at retail rates.

Property Assessed Clean Energy (PACE) [82]**–** Act 45 was passed by the Vermont State Legislature in May 2009 allowing Vermont communities to establish property assessed clean energy (PACE) districts to make it easier for building owners to invest in energy efficiency and / or renewable energy projects in existing homes and businesses. This new program will allow for re-payment terms that are longer, which may encourage more customers to undertake energy efficiency projects. It also allows for electric, thermal and renewable energy projects to be funded in a way that keeps both the benefits and the payment obligation tied to the property should it change hands.

Vermont Comprehensive Energy Plan – Energy Plan describes Vermont's current energy demands, sources of energy, policies and programs that address energy use and long term goals for the future including attaining 90% of Vermont's energy from renewable sources by 2050[83]**.**

Vermont's Low Income Weatherization Services – Stably funded program that provides more comprehensive services than other states with whole house assessments, state of the art building diagnostics and full service retrofits with air sealing, insulation and heating system upgrades.

Vermont Clean Cities Coalition –promotes vehicle fuel efficiency, alternative fueled vehicles including electric vehicles, transportation alternatives, anti-idling campaigns and programs that reduce vehicle miles travelled. This initiative is housed at the UVM Transportation Research Center.

Building Energy Codes – Vermont has both residential and commercial minimum energy efficiency standards for new construction and major renovation.

Burlington District Energy System – is a plan for the McNeil Station to produce and transport steam to close by facilities (e.g. University of Vermont, Fletcher Center) to use for space heating and domestic hot water, eliminating the need for individual systems**.** This system would provide environmental benefits by displacing fossil fuels and using wood from Vermont forests.

[82] http://www.efficiencyvermont.com/about_us/energy_initiatives/pace.aspx
[83] http://www.vtenergyplan.vermont.gov/

Conclusions

As has become evident throughout the report, a large number of factors affect energy consumption, supply, and needs. These range from population growth, economics, fuel choices, technology advances, public policy and regulations, to land use. Needs are different by sectors, and different for rural and urban areas.

The results of this report highlight strengths and weaknesses of available energy data. For example electricity and gas consumption is tracked by utilities and can be reported at the town level. Other fossil fuels are tracked at the state level and many assumptions need to be made to assign then to the town level. For commercial and industrial this is impossible without more research to identify the types of business that are located in each town, and even with that it would be difficult to produce town level results. As planners choose indicators and baselines from which to measure progress of initiatives and plans, careful understanding of data quality will be important to choose the appropriate indicator.

Municipal planners in Vermont have extensive resources to use while developing and implementing an energy plan. Vermont leads the nation with respect to initiatives that support efficiency and renewables including incentive programs and technical assistance that can be leveraged by municipalities. The Vermont legislature has put in place enabling legislation to adopt PACE which would promote more weatherization in a town. The state has developed a progressive comprehensive energy plan that municipalities can align activities with the state long term goals of energy reductions and renewable energy production.

Planning for the energy section of a sustainability plan cannot be done in isolation from other key components of society, such as the economy, housing, health, land use, transportation, etc. This is where the ECOS project gains its strength by bringing together the many different sectors that influence the path toward sustainability.

Appendix A: Overview of Data Sources and Assumptions Use in Report Analysis and Appendix B

Energy Trends by Fuel 1990-2009 for residential, commercial and industrial, and transportation sectors: Energy Information Agency (EIA), http://www.eia.gov/state/state-energy-profiles.cfm?sid=VT. Data was extrapolated for Chittenden County using the ratio of households in Chittenden County vs. Vermont (25%) and businesses in Chittenden County vs. Vermont (33%).

Energy End-use Analysis

Residential Assumptions: Electrical consumption by end use was calculated using market penetration data adjusted for towns that do not have access to natural gas service. Consumption was calculated by multiplying the number of household by the penetration rate and the unit energy consumption (UEC).

Due to assumptions made regarding the penetration rate of technologies in Chittenden County, and assuming that they are the same in Vermont as a whole, and estimating these rates in towns without natural gas leads to imprecision when reporting the sum of all end uses for each town.

Therefore, aggregated town level consumption data from the Efficiency Vermont Website should be used when considering the sum of all electrical end-uses in Chittenden County

References used for electricity consumption:

- Efficiency Vermont Town level data, 2009, http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx
- Market Penetration: "Overall Report for Existing Homes in Vermont FINAL, Submitted to : Vermont Department of Public Service, Submitted by: Nexus Market search, Inc., RLW Analytics, Inc., Dorothy Conant, June 8, 2009", and professional judgment where indicated.
- ACS 2006: American Community Survey, Census Bureau, 2006
- Energy Information Agency, Residential Energy Consumption Surveys, 2009, Appliances and Consumer Electronics in Northeast Region.
- Combination of the end use and fuel type assumptions were used to calculate the thermal fuel split by end use and Town.

Thermal fuels consumption by end use was calculated differently for natural gas and other fuels, because Town level consumption data was only available for natural gas. For natural gas, the Town's consumption is multiplied by the percentage attributed to each end use. For other thermal fuels, the statewide consumption data was multiplied by each Town's proportion of non-natural gas customer's to the total number of households in Vermont. This Town level consumption was then multiplied by the percentage attributed to each end use for each fuel. Town specific data was provided by Vermont Gas for Chittenden County Towns.

Due to the high level data source used for thermal fuels (state level data for all fuels but natural gas), and assumptions regarding what proportion of households using one fuel for heat and/or hot water, the end-use results by Town must be taken cautiously with a clear understanding of the limitation of the data and the resulting low precision of the Town level data for fuels other than natural gas.

References used for thermal fuel consumption:

- Town level residential consumption data provided by Vermont Gas, 2010
- Number of households: Efficiency Vermont Town level data, 2009, http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx
- Energy Information Agency, Residential Sector Energy Consumption Estimates, 1960-2009, Vermont (http://www.eia.gov/state/seds/hf.jsp?incfile=sep_use/res/use_res_VT.html&mstate=Vermont)
- Professional judgment where data was not avialble

Commercial Assumptions

- Obtained EIA data for commercial and industrial for "Non-Electric Fuel Use" in Vermont
- Used available information and professional judgment to allocate percent of specific fuel use to Chittenden County
- Obtained CBECS data which determines the percent of energy, by end use by fuel type.
- Used distribution of energy used between building type to allocate energy by building, then used percent distribution to end use.
- CBECS building types and Industrial were merged into the building types used by the electric study.
- Number of businesses is census category called "private number of non-farm establishments" 2008

Transportation

- **Annual Trips**: Base year trip Production model: CCRPC (formerly CCMPO), data from PowerPoint presented for CCRPC Transportation Model Training Session, September 7, 2011.
- **VMT:** Data source: VTrans HPMS Data, Chittenden County VTrans Vehicle Miles of Travel (VMT) History, CCMPO 2009
- **Cars gas mileage** CAFÉ fuel economy standards: average gas mileage of new cars sold from 1978 to 2010
- **2009 road miles by town**: http://www.aot.state.vt.us/Planning/Documents/HighResearch/Publications/2009HwyMiles_town.pdf , Figures reported as of February 10, 2009
- **Number of workers who did not work at home**: http://www.ccmpo.org/data/ctpp/Chittenden_County.pdf
- **Number of trips annually annual miles** : **residential** : U.S. Department of Transportation, Federal Highway Administration, 1990 Nationwide Personal Transportation Survey: Summary of Travel Trends, FHWA-PL-92-027, Washington, DC, March 1992, Table 7. 1990 adjusted data - Oak Ridge National Laboratory, Oak Ridge, TN, August 1998. 1995 NPTS, 2001 and 2009 NHTS data were generated from the Internet site nhts.ornl.gov . (Additional resources: www.fhwa.dot.gov , www-cta.ornl.gov/npts)
- **Commercial:** CCMPO freight study

Appendix B – Excel spreadsheets

Energy Consumption Estimates for Chittenden Co

Table of Contents:

Residential Method and References
Residential Summary
Residential Detailed
Residential Calculations & References
C&I Methods References
C&I Building Summary Data
C&I Building Type & End Use
C&I Calculations and References

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Electrical consumption by end use was calculated using market penetration data adjusted for tow
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References used for electricity consumption:
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- Energy Information Agency, Residential Sector Energy Consumption Estimates, 1960-2009, Verm
(http://www.eia.gov/state/seds/hf.jsp?incfile=sep_use/res/use_res_VT.html&mstate=Vermont)
- Professional judgment where data was not available

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nt.com/about_us/energy_initiatives/vt_town_energy.aspx
ont

Energy Used by Buildings (Non-transportation)

		BOLTON	BUELS GORE	BURLINGTON
	Number of households	571	5	16,101
Total MMBTU consumption	Electricity	13,878	51	292,005
	Oil	27,616	242	143,610
	Natural Gas	-	-	923,092
	Wood	1,932	17	10,199
	Propane	3,201	28	16,898
	Total	47,198	343	1,401,905
Per household MMBTU consumption	Electricity	24	10	18
	Oil	48	48	9
	Natural Gas	-	-	57
	Wood	3	3	1
	Propane	6	6	1
	Total	82	68	86

CHARLOTTE	COLCHESTER	ESSEX	ESSEX JUNCTION	HINESBURG	HUNTINGTON
1,732	7,051	3,231	4,638	1,872	810
52,287	166,151	83,805	107,188	46,738	19,523
83,767	143,866	41,814	74,253	69,678	39,175
-	256,964	191,937	246,959	12,381	-
5,860	10,217	2,970	5,273	4,948	2,741
9,709	16,928	4,920	8,737	8,199	4,541
153,356	601,176	328,677	447,049	143,816	66,790
30	24	26	23	25	24
48	20	13	16	37	48
-	36	59	53	7	-
3	1	1	1	3	3
6	2	2	2	4	6
88	84	101	95	76	81

JERICHO	MILTON	RICHMOND	SHELBURNE	SOUTH BURLINGTON	ST. GEORGE
1,916	4,211	1,708	2,787	7,807	293
52,031	111,413	44,936	83,286	174,770	7,494
58,363	111,068	82,606	59,044	103,794	14,171
46,431	112,098	-	128,126	451,934	-
4,145	7,888	5,779	4,193	7,371	991
6,867	13,069	9,575	6,947	12,213	1,643
169,753	359,747	144,604	284,383	757,890	24,591
27	26	26	30	22	26
30	26	48	21	13	48
24	27	-	46	58	-
2	2	3	2	1	3
4	3	6	2	2	6
88	84	84	101	96	83

UNDERHILL	WESTFORD	WILLISTON	WINOOSKI	Total
1,246	823	3,479	2,994	63,275
33,191	22,897	87,765	55,752	1,455,159
49,728	39,804	66,062	33,180	1,241,841
7,167	-	150,740	160,942	2,688,773
3,532	2,785	4,692	2,356	87,889
5,851	4,614	7,773	3,904	145,615
100,714	70,922	320,511	259,128	5,682,552
27	28	25	19	23
40	48	19	11	20
6	-	43	54	42
3	3	1	1	1
5	6	2	1	2
80	85	91	86	89

Data sources and comments (see reference tab for details):
Efficiency Vermont Town level data (2009)
Efficiency Vermont Town level data (2009)
Estimated using statewide EIA data (2009)
Vermont Gas Town Level data (2010)
Estimated using statewide EIA data (2009)
Estimated using statewide EIA data (2009)

	Fuel or Category	End use	BOLTON	BUELS GORE
Electric (kWh)	Space Heating	Electric - primary	114,200	1,000
		Electric - back-up	11,420	100
		Furnace circ fans	151,886	1,330
		Boiler circ pumps	99,354	870
		Humidifier	4,996	44
	Cooling/Dehum	Central AC	40,905	358
		Room AC	126,239	1,105
		Dehumidifier	51,390	450
	Water Heating	Electric DHW	818,181	7,164
	Kitchen	Refrigerators	325,470	2,850
		Freezer	188,609	1,652
		Dishwasher	50,199	440
		Electric cooktop	120,709	1,057
		Electric oven	86,221	755
		Microwave	62,953	551
	Laundry	Clothes Washers	57,037	499
		Electric dryer	375,147	3,285
	Spa/Pool	Pool pump	62,525	548
		Spa	37,346	327
	Lighting	Lighting	701,838	6,146
	Consumer Electronics	Computer & peripherals	145,605	1,275
		TV - std	284,073	2,488
		TV - large	85,650	750
		Cable or Satellite box	157,865	1,382
		DVD/VCR player	77,463	678
	Other	Waterbed	6,578	58
		Well pump	11,991	105
		Misc	342,600	3,000
	Total all end uses	Sum of end uses	4,598,449	40,267
		Efficiency Vermont aggregated Town level data	4,067,392	14,937
Natural gas		Number of households	-	-
		Space Heating	-	-
		Water Heating	-	-

Fossil Fuels (MMBTU)	Natural gas	Kitchen	-	-
		Laundry	-	-
		Other	-	-
		Total consumption (MMBTU)	-	-
	Oil	Number of households	575	5
		Space Heating	24,854	218
		Water Heating	2,762	24
		Kitchen	-	-
		Laundry	-	-
		Other	-	-
		Total consumption	27,616	242
	Propane	Number of households	144	1
		Space Heating	2,273	20
		Water Heating	544	5
		Kitchen	384	3
		Laundry	-	-
		Other	-	-
		Total consumption	3,201	28
	Wood	Number of households	125	1
		Space Heating	1,932	17
		Water Heating	-	-
		Kitchen	-	-
		Laundry	-	-
		Other	-	-
		Total consumption	1,932	17

BURLINGTON	CHARLOTTE	COLCHESTER	ESSEX	ESSEX JUNCTION	HINESBURG
3,220,200	346,400	1,410,200	646,200	927,600	374,400
322,020	34,640	141,020	64,620	92,760	37,440
4,551,127	460,712	1,993,044	913,278	1,310,982	529,142
2,879,817	301,368	1,261,138	577,895	829,550	334,825
140,884	15,155	61,696	28,271	40,583	16,380
1,153,443	124,077	505,120	231,462	332,257	134,106
3,559,669	382,917	1,558,861	714,321	1,025,386	413,869
1,449,090	155,880	634,590	290,790	417,420	168,480
6,440,400	2,481,769	2,820,400	1,292,400	1,855,200	748,800
9,177,570	987,240	4,019,070	1,841,670	2,643,660	1,067,040
5,318,378	572,103	2,329,040	1,067,243	1,531,994	618,347
1,415,513	152,268	619,886	284,052	407,748	164,576
2,254,140	366,145	987,140	452,340	649,320	262,080
1,610,100	261,532	705,100	323,100	463,800	187,200
1,775,135	190,953	777,373	356,218	511,340	206,388
1,608,316	173,008	704,319	322,742	463,286	186,993
10,143,630	1,137,924	4,442,130	2,035,530	2,921,940	1,179,360
1,763,060	189,654	772,085	353,795	507,861	204,984
1,053,086	113,281	461,171	211,324	303,348	122,438
19,790,343	2,128,866	8,666,649	3,971,343	5,700,740	2,300,945
4,105,755	441,660	1,798,005	823,905	1,182,690	477,360
8,009,040	861,670	3,507,344	1,607,180	2,307,057	931,180
2,415,150	259,800	1,057,650	484,650	695,700	280,800
4,451,453	478,847	1,949,394	893,276	1,282,271	517,553
2,184,290	234,966	956,551	438,323	629,199	253,959
185,484	19,953	81,228	37,221	53,430	21,565
338,121	36,372	148,071	67,851	97,398	39,312
9,660,600	1,039,200	4,230,600	1,938,600	2,782,800	1,123,200
110,975,813	13,948,361	48,598,873	22,269,601	31,967,320	12,902,722
85,581,711	15,324,571	48,696,069	24,561,712	31,415,140	13,698,115
12,725	-	3,669	2,248	2,892	234
619,093	-	172,339	128,727	165,628	8,303
115,748	-	32,221	24,067	30,967	1,552

77,687	-	21,626	16,153	20,784	1,042
70,371	-	19,590	14,632	18,827	944
36,810	-	10,247	7,654	9,848	494
923,092	-	256,964	191,937	246,959	12,381
2,988	1,743	2,993	870	1,545	1,450
129,249	75,390	129,479	37,633	66,828	62,710
14,361	8,377	14,387	4,181	7,425	6,968
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
143,610	83,767	143,866	41,814	74,253	69,678
760	436	761	221	393	369
11,997	6,894	12,019	3,493	6,203	5,821
2,873	1,651	2,878	836	1,485	1,394
2,028	1,165	2,031	590	1,048	984
-	-	-	-	-	-
-	-	-	-	-	-
16,898	9,709	16,928	4,920	8,737	8,199
658	378	659	192	340	319
10,199	5,860	10,217	2,970	5,273	4,948
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
10,199	5,860	10,217	2,970	5,273	4,948

HUNTINGTON	JERICHO	MILTON	RICHMOND	SHELBURNE	SOUTH BURLINGTON
162,000	383,200	842,200	341,600	557,400	1,561,400
16,200	38,320	84,220	34,160	55,740	156,140
215,460	541,579	1,190,286	454,328	787,777	2,206,736
140,940	342,695	753,177	297,192	498,481	1,396,356
7,088	16,765	36,846	14,945	24,386	68,311
58,027	137,258	301,668	122,358	199,655	559,278
179,078	423,596	930,984	377,611	616,160	1,726,001
72,900	172,440	378,990	153,720	250,830	702,630
1,160,643	766,400	1,684,400	2,447,380	1,114,800	3,122,800
461,700	1,092,120	2,400,270	973,560	1,588,590	4,449,990
267,554	632,881	1,390,950	564,175	920,584	2,578,757
71,211	168,444	370,208	150,158	245,018	686,349
171,234	268,240	589,540	361,071	390,180	1,092,980
122,310	191,600	421,100	257,908	278,700	780,700
89,303	211,239	464,263	188,307	307,267	860,722
80,910	191,388	420,633	170,611	278,391	779,835
532,170	1,207,080	2,652,930	1,122,156	1,755,810	4,918,410
88,695	209,802	461,105	187,026	305,177	854,867
52,978	125,316	275,420	111,712	182,284	510,617
995,601	2,355,027	5,175,898	2,099,367	3,425,606	9,595,876
206,550	488,580	1,073,805	435,540	710,685	1,990,785
402,975	953,066	2,094,657	849,730	1,386,323	3,883,397
121,500	287,400	631,650	256,200	418,050	1,171,050
223,941	529,718	1,164,218	472,212	770,524	2,158,406
109,886	259,928	571,272	231,710	378,089	1,059,111
9,331	22,072	48,511	19,676	32,106	89,937
17,010	40,236	88,431	35,868	58,527	163,947
486,000	1,149,600	2,526,600	1,024,800	1,672,200	4,684,200
6,523,194	13,205,991	29,024,231	13,755,081	19,209,341	53,809,588
5,721,920	15,249,432	32,653,197	13,169,921	24,409,693	51,222,208
-	544	1,600	-	1,399	5,367
-	31,140	75,181	-	85,931	303,100
-	5,822	14,056	-	16,066	56,669

-	3,908	9,434	-	10,783	38,034
-	3,540	8,546	-	9,768	34,453
-	1,852	4,470	-	5,109	18,022
-	46,431	112,098	-	128,126	451,934
815	1,214	2,311	1,719	1,228	2,159
35,258	52,527	99,961	74,346	53,139	93,415
3,918	5,836	11,107	8,261	5,904	10,379
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
39,175	58,363	111,068	82,606	59,044	103,794
204	309	587	430	312	549
3,224	4,876	9,279	6,798	4,933	8,671
772	1,167	2,222	1,628	1,181	2,076
545	824	1,568	1,149	834	1,466
-	-	-	-	-	-
-	-	-	-	-	-
4,541	6,867	13,069	9,575	6,947	12,213
177	268	509	373	271	476
2,741	4,145	7,888	5,779	4,193	7,371
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
2,741	4,145	7,888	5,779	4,193	7,371

ST. GEORGE	UNDERHILL	WESTFORD	WILLISTON	WINOOSKI	Total
58,600	249,200	164,600	695,800	598,800	12,655,000
5,860	24,920	16,460	69,580	59,880	1,265,500
77,938	352,196	218,918	983,378	846,287	17,786,384
50,982	222,859	143,202	622,252	535,505	11,288,460
2,564	10,903	7,201	30,441	26,198	553,656
20,990	89,261	58,958	249,229	214,484	4,532,895
64,778	275,470	181,952	769,150	661,925	13,989,072
26,370	112,140	74,070	313,110	269,460	5,694,750
419,837	498,400	1,179,270	1,391,600	1,197,600	31,447,446
167,010	710,220	469,110	1,983,030	1,706,580	36,066,750
96,782	411,571	271,848	1,149,161	988,959	20,900,587
25,759	109,542	72,354	305,855	263,216	5,562,798
61,940	174,440	173,982	487,060	419,160	9,282,759
44,243	124,600	124,273	347,900	299,400	6,630,542
32,303	137,372	90,736	383,560	330,089	6,976,069
29,268	124,462	82,209	347,515	299,068	6,320,489
192,501	784,980	540,711	2,191,770	1,886,220	40,023,684
32,084	136,437	90,119	380,951	327,843	6,928,613
19,164	81,495	53,828	227,544	195,823	4,138,501
360,137	1,531,505	1,011,580	4,276,169	3,680,038	77,773,675
74,715	317,730	209,865	887,145	763,470	16,135,125
145,768	619,792	409,443	1,730,542	1,489,290	31,475,013
43,950	186,900	123,450	521,850	449,100	9,491,250
81,006	344,482	227,535	961,841	827,753	17,493,676
39,749	169,035	111,650	471,967	406,171	8,583,998
3,375	14,354	9,481	40,078	34,491	728,928
6,153	26,166	17,283	73,059	62,874	1,328,775
175,800	747,600	493,800	2,087,400	1,796,400	37,965,000
2,359,625	8,588,030	6,627,887	23,978,936	20,636,084	443,019,394
2,196,267	9,727,605	6,710,615	25,722,336	16,339,856	426,482,697
-	77	-	1,926	2,214	35,230
-	4,807	-	101,097	107,940	1,803,286
-	899	-	18,902	20,181	337,151

-	603	-	12,686	13,545	226,285
-	546	-	11,492	12,269	204,977
-	286	-	6,011	6,418	107,219
-	7,167	-	150,740	160,942	2,688,773
295	1,035	828	1,374	690	25,836
12,754	44,755	35,823	59,456	29,862	1,117,657
1,417	4,973	3,980	6,606	3,318	124,184
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
14,171	49,728	39,804	66,062	33,180	1,241,841
74	263	207	349	176	6,546
1,166	4,154	3,276	5,519	2,772	103,387
279	995	784	1,321	664	24,755
197	702	554	933	468	17,474
-	-	-	-	-	-
-	-	-	-	-	-
1,643	5,851	4,614	7,773	3,904	145,615
64	228	180	303	152	5,673
991	3,532	2,785	4,692	2,356	87,888
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
991	3,532	2,785	4,692	2,356	87,889

Total kWh by Category	Average per household consumption (kWh)	Percent of total by category/ Comment
43,549,000	688	10%
24,216,717	383	5%
31,447,446	497	7%
85,419,504	1,350	19%
46,344,173	732	10%
11,067,114	175	2%
77,773,675	1,229	18%
83,179,062	1,315	19%
40,022,703	633	9%
443,019,394	7,001	
		Differences between the sum of end use and the aggregated Town level data are due to assumptions necessary to disaggregate electrical consumption by end use. When comparing Towns at the aggregated level, Efficiency Vermont's Town level data should be used.

Electricity

Electrical consumption by end use was calculated using market penetration data adjusted fo
and the unit energy consumption (UEC).
Due to assumptions made regarding the penetration rate of technologies in Chittenden Cour
reporting the sum of all end uses for each town.
Therefore, aggregated town level consumption data available on the Efficiency Vermont Wel

Table Title: Electric consumption of Chittenden County households
Source: Efficiency Vermont Town level data, 2009

	2009 kWh Usage
EVT Census Town	**kWh Usage: Residential Sector**
BOLTON	4,067,392
BUELS GORE	14,937
BURLINGTON	85,581,711
CHARLOTTE	15,324,571
COLCHESTER	48,696,069
ESSEX	24,561,712
ESSEX JUNCTION	31,415,140
HINESBURG	13,698,115
HUNTINGTON	5,721,920
JERICHO	15,249,432
MILTON	32,653,197
RICHMOND	13,169,921
SHELBURNE	24,409,693
SOUTH BURLINGTON	51,222,208
ST. GEORGE	2,196,267
UNDERHILL	9,727,605
WESTFORD	6,710,615
WILLISTON	25,722,336
WINOOSKI	16,339,856
Total	**426,482,697**

Table Title: Market penetration, Unit Energy Consumption (2009 data), and electricity co
Source: Market Penetration: "Overall Report for Existing Homes in Vermont FINAL, Su
professional judgment where indicated.
UEC: professional judgment

End Use

End use	**Technology/ Measure**
Households	
Space Heating	Electric - primary
	Electric - back-up
	Furnace circ fans
	Boiler circ pumps
	Humidifier
Cooling/Dehum	Central AC
	Room AC
	Dehumidifier
Water Heating	Electric DHW
Kitchen	Refrigerators
	Freezer
	Dishwasher
	Electric cooktop
	Electric oven
	Microwave
Laundry	Clothes Washers
	Electric dryer
Spa/Pool	Pool pump
	Spa
Lighting	Lighting
Consumer Electronics	Computer & peripherals
	TV - std
	TV - large
	Cable or Satellite box
	DVD/VCR player
Other	Waterbed
	Well pump
	Misc
	Sum of end uses
	Efficiency Vermont aggregated Town level data

Total	Percent difference (due to assumptions necessary to disaggregate electrical consumption by end use)

Thermal Fuels (Natural Gas, Oil, Propane, Wood)

Thermal fuels consumption by end use was calculated differently for natural gas and other fu
attributed to each end use. For other thermal fuels, the statewide consumption was multipli
multiplied by the percentage attributed to each end use for each fuel. See tables below for d

Table Title: Disaggregation between space heating, water heating, and other
Source: Therm Disag tab in previous file for natural gas, adjusted using professional ju

End Use	Oil
Space Heating	90%
Water Heating	10%
Kitchen	0%
Laundry	0%
Other	0%

Table Title: Primary heating and hot water disaggregation by fuel for towns with and witl
Source: Market Penetration: "Overall Report for Existing Homes in Vermont FINAL, Su

	Primary and Secondary H
Fuel Type	Town with natural gas (source VT RES Market tab-ACS 2006)
Oil	89%
Natural Gas	
Wood	20%
Propane	23%
Electric	2%
Other	0%
	132%

Table Title: Energy Information Agency Fuel Consumption data for Vermont (non transpo
Source: Residential Sector Energy Consumption Estimates, 1960-2009, Vermont -incl

Fuel Type	Total Vermont (2009)
Fuel Oil (trillion BTU)	12.1
Natural gas (trillion BTU)	3.2
Wood (trillion BTU)	3.9
Propane (trillion BTU)	5.6
Other: Kerosene (trillion BTU)	0.9
Total (trillion BTU)	25.7

Table Title: Number of Households in Chittenden County and Vermont
Source: Efficiency Vermont data, 2009

	VT households
Number of households	251,736
Proportion of Chittenden County Household to Vermont household	

Table Title: Number of gas and non-gas customers by Town
Source: Natural Gas data (accounts and annual consumption) from Vermont Gas, 201

Fuel Type	EVT Census Town
All Fuels	2009 Number of Households (Updated 2009, includes vacant)
Natural gas	2010 Natural Gas customers (source VT gas)
Oil, propane, wood	Non-natural gas customers
Natural gas	Residential consumption in 2010 (ccf of gas)
	Residential consumption in 2010 (MMBTU)

Table Title: Thermal fuels consumption by fuel, end-use, and Town
Source: Natural Gas consumption was multiplied by fuel type breakdown to obtain e

Fuel	End Use
	Number of households

Natural gas	Space Heating
	Water Heating
	Kitchen
	Laundry
	Other
	Total consumption (MMBTU)
Oil	Number of households
	Space Heating
	Water Heating
	Kitchen
	Laundry
	Other
	Total consumption
Propane	Number of households
	Space Heating
	Water Heating
	Kitchen
	Laundry
	Other
	Total consumption
Wood	Number of households
	Space Heating
	Water Heating
	Kitchen
	Laundry
	Other
	Total consumption

r towns that do not have access to natural gas service. Consumption was calculated by multi

nty, and assuming that they are the same in Vermont as a whole, and estimating these rates

bsite should be used when considering the sum of all electrical end-uses in Chittenden Coun

2009 kWh Savings		Ratios for 2009 Data
kWh Savings: Residential Sector	Number of Households (Updated 2009)	Average Residential kWh Usage/ Household
16,306	571	7,123
401	5	2,987
1,698,000	16,101	5,315
369,037	1,732	8,848
2,911,174	7,051	6,906
565,411	3,231	7,602
1,059,811	4,638	6,773
197,754	1,872	7,317
76,658	810	7,064
327,000	1,916	7,959
801,409	4,211	7,754
322,023	1,708	7,711
615,621	2,787	8,758
2,355,946	7,807	6,561
108,425	293	7,496
274,383	1,246	7,807
99,297	823	8,154
736,016	3,479	7,394
462,321	2,994	5,458
12,996,994	**63,275**	**7,105**

nsumption by Town and end-use

ubmitted to :Vermont Department of Public Service, Submitted by: Nexus Market search, In

Assumptions

Market Penetration Town with Natural Gas Service	Market Penetration Town without Natural Gas Service	Comment on Market Penetration
2%	2%	professional judgment for towns without natural gas
2%	2%	
40%	38%	
60%	58%	
5%	5%	
5%	5%	
70%	70%	
30%	30%	
10%	36%	professional judgment for towns without natural gas
114%	114%	
44%	44%	
59%	59%	
40%	60%	professional judgment for towns without natural gas
40%	60%	professional judgment for towns without natural gas
74%	74%	
92%	92%	
70%	73%	source: EIA RECs for Northeast region; professional judgment for towns without natural gas
10%	10%	
2%	2%	
100%	100%	
102%	102%	
199%	199%	source: EIA RECs for Northeast region;
30%	30%	
138%	138%	
181%	181%	
1%	1%	
15%	15%	
100%	100%	

uels, because Town level consumption data was only available for natural gas. For natural ga
ed by each Town's proportion of non-natural gas customer's to the total number of household
letails.

udgment for other fuels

Percent of Total Fuel Consumption		
Natural Gas	**Wood**	**Propane**
67%	100%	71%
13%	0%	17%
8%	0%	12%
8%	0%	0%
4%	0%	0%

hout natural gas

ubmitted to :Vermont Department of Public Service, Submitted by: Nexus Market search, Inc.

Heating fuel type	**Primary Heating fuel type**	
Town without natural gas (assumes proportional distribution of would-be natural gas users to other fuels)	**Town with natural gas (source VT RES Market tab-ACS 2006)**	**Town without natural gas (assumes proportional distribution of would-be natural gas users to other fuels)**
101%	59%	67%
	50%	0%
22%	13%	15%
25%	15%	17%
2%	1%	1%
0%	0%	0%
149%	138%	100%

ortation)

udes multifamily-(http://www.eia.gov/state/seds/hf.jsp?incfile=sep_use/res/use_res_VT.ht

Total Chittenden (2009)	Percent of Statewide Consumption attributed to Chittenden County	Comments
1.2	10%	
2.5	78%	Assumes that residents of Chittend
0.1	2%	
0.1	3%	Vermont gas provides services to 45,
0.2	25%	number of total VT gas customers. A
4.2	16%	

CC households
63,583
25%

.0 data.

BOLTON	BUELS GORE	BURLINGTON
571	5	16,101
-	-	12,725
571	5	3,376
		9,230,920
		923,092

nd use consumption data for natural gas.

-	-	Access to Natural gas
BOLTON	**BUELS GORE**	**BURLINGTON**
-	-	12,725

-	-	619,093
-	-	115,748
-	-	77,687
-	-	70,371
-	-	36,810
-	**-**	**923,092**
575	5	2,988
24,854	218	129,249
2,762	24	14,361
-	-	-
-	-	-
-	-	-
27,616	**242**	**143,610**
144	1	760
2,273	20	11,997
544	5	2,873
384	3	2,028
-	-	-
-	-	-
3,201	**28**	**16,898**
125	1	658
1,932	17	10,199
-	-	-
-	-	-
-	-	-
-	-	-
1,932	**17**	**10,199**

iplying the number of household by the penetration rate

in towns without natural gas leads to imprecision when

ty

Average Residential kWh Savings/ Household	Savings as % of Usage	Difference in usage/household compared to Chittenden County average	
29	0.4%	0%	
80	2.7%	-58%	very small number of
105	2.0%	-25%	more multifamily hou
213	2.4%	25%	larger homes than ave
413	6.0%	-3%	
175	2.3%	7%	
229	3.4%	-5%	
106	1.4%	3%	
95	1.3%	-1%	
171	2.1%	12%	
190	2.5%	9%	
189	2.4%	9%	
221	2.5%	23%	larger homes than ave
302	4.6%	-8%	
370	4.9%	6%	
220	2.8%	10%	
121	1.5%	15%	
212	2.9%	4%	
154	2.8%	-23%	more multifamily hou
189	**2.7%**	0%	

c., RLW Analytics, Inc., Dorothy Conant, June 8, 2009", and

	-	-	Access to Natural gas
Unit Energy Consumption UEC (kWh)	**BOLTON**	**BUELS GORE**	**BURLINGTON**
	571	5	16,101
10,000	11	0.10	322
1,000	11	0	322
700	217	2	6,502
300	331	3	9,599
175	29	0	805
1,547	26	0	745
316	400	4	11,271
300	171	2	4,830
4,000	205	2	1,610
500	651	6	18,355
750	251	2	7,091
150	335	3	9,437
350	345	3	6,440
250	345	3	6,440
150	420	4	11,834
108	528	5	14,892
900	417	4	11,271
1,095	57	1	1,610
3,270	11	0	322
1,229	571	5	16,101
250	582	5	16,423
250	1,136	10	32,036
500	171	2	4,830
200	789	7	22,257
75	1,033	9	29,124
1,152	6	0	161
140	86	1	2,415
600	571	5	16,101

s, the Town's consumption is multiplied by the percentage
olds in Vermont. This Town level consumption was then

, RLW Analytics, Inc., Dorothy Conant, June 8, 2009", and professional judgment where indicated. ACS 2006: Am

	Comment
	Assumes that 20% of households also use that fuel as secondary heating fuel
	Assumes that 90% of households with access to natural gas heat their home and hot water with natural gas
	Assumes that 20% of households also use that fuel as secondary heating fuel

ml&mstate=Vermont)

en County use 25% of the residential thermal fuels used in Vermont, the same share as CC's share of Vermont's household.

000 homes and businesses; Chittenden County residences (35,230) represent 78% of the

ıssuming all customers use the same amount of gas, 75% of Vermont's gas consumption was assumed to occur in Chittenden County.

	Essex+Essex Junction consumption		4,388,962
	Essex+Essex Junction customers		5,140
CHARLOTTE	**COLCHESTER**	**ESSEX**	**ESSEX JUNCTION**
1,732	7,051	3,231	4,638
-	3,669	2,248	2,892
1,732	3,382	983	1,746
	2,569,640	1,919,374.37	2,469,587.63
	256,964	191,937	246,959

-	Access to Natural gas	Access to Natural gas	Access to Natural gas
CHARLOTTE	**COLCHESTER**	**ESSEX**	**ESSEX JUNCTION**
-	3,669	2,248	2,892

-	172,339	128,727	165,628
-	32,221	24,067	30,967
-	21,626	16,153	20,784
-	19,590	14,632	18,827
-	10,247	7,654	9,848
-	**256,964**	**191,937**	**246,959**
1,743	2,993	870	1,545
75,390	129,479	37,633	66,828
8,377	14,387	4,181	7,425
-	-	-	-
-	-	-	-
-	-	-	-
83,767	**143,866**	**41,814**	**74,253**
436	761	221	393
6,894	12,019	3,493	6,203
1,651	2,878	836	1,485
1,165	2,031	590	1,048
-	-	-	-
-	-	-	-
9,709	**16,928**	**4,920**	**8,737**
378	659	192	340
5,860	10,217	2,970	5,273
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
5,860	**10,217**	**2,970**	**5,273**

Comments
houses in Buel's Gore , outliers have greater impact
sing compared to the average
erage
erage
sing compared to the average

Number of product (pug load, electric heat, and electric direct water heater) per

-	Access to Natural gas	Access to Natural gas	Access to Natural gas	Access to Natural gas	-	Access to Natural gas	Access to Natural gas
CHARLOTTE	**COLCHESTER**	**ESSEX**	**ESSEX JUNCTION**	**HINESBURG**	**HUNTINGTON**	**JERICHO**	**MILTON**
1,732	7,051	3,231	4,638	1,872	810	1,916	4,211
35	141	65	93	37	16	38	84
35	141	65	93	37	16	38	84
658	2,847	1,305	1,873	756	308	774	1,700
1,005	4,204	1,926	2,765	1,116	470	1,142	2,511
87	353	162	232	94	41	96	211
80	326	150	215	87	38	89	195
1,212	4,936	2,262	3,247	1,310	567	1,341	2,948
520	2,115	969	1,391	562	243	575	1,263
620	705	323	464	187	290	192	421
1,974	8,038	3,683	5,287	2,134	923	2,184	4,801
763	3,105	1,423	2,043	824	357	844	1,855
1,015	4,133	1,894	2,718	1,097	475	1,123	2,468
1,046	2,820	1,292	1,855	749	489	766	1,684
1,046	2,820	1,292	1,855	749	489	766	1,684
1,273	5,182	2,375	3,409	1,376	595	1,408	3,095
1,602	6,521	2,988	4,290	1,731	749	1,772	3,895
1,264	4,936	2,262	3,247	1,310	591	1,341	2,948
173	705	323	464	187	81	192	421
35	141	65	93	37	16	38	84
1,732	7,051	3,231	4,638	1,872	810	1,916	4,211
1,767	7,192	3,296	4,731	1,909	826	1,954	4,295
3,447	14,029	6,429	9,228	3,725	1,612	3,812	8,379
520	2,115	969	1,391	562	243	575	1,263
2,394	9,747	4,466	6,411	2,588	1,120	2,649	5,821
3,133	12,754	5,844	8,389	3,386	1,465	3,466	7,617
17	71	32	46	19	8	19	42
260	1,058	485	696	281	122	287	632
1,732	7,051	3,231	4,638	1,872	810	1,916	4,211

ıerican Community Survey, Census Bureau, 2006 Market Penetration: "Overall Report for Existing Homes in Verm

(Essex/ Essex Jnct consumption only available as aggregation of both Towns at the time of this writing)

HINESBURG	HUNTINGTO	JERICHO	MILTON	RICHMOND	SHELBURNE	SOUTH BURLI	ST. GEORGE
1,872	810	1,916	4,211	1,708	2,787	7,807	293
234	-	544	1,600	-	1,399	5,367	-
1,638	810	1,372	2,611	1,708	1,388	2,440	293
123,808		464,312	1,120,983		1,281,264	4,519,341	
12,381	-	46,431	112,098	-	128,126	451,934	-

Access to Natural gas	-	Access to Natural gas	Access to Natural gas	-	Access to Natural gas	Access to Natural gas	-
HINESBURG	**HUNTINGTON**	**JERICHO**	**MILTON**	**RICHMOND**	**SHELBURNE**	**SOUTH BURLINGTON**	**ST. GEORGE**
234	-	544	1,600	-	1,399	5,367	-

8,303	-	31,140	75,181	-	85,931	303,100	-
1,552	-	5,822	14,056	-	16,066	56,669	-
1,042	-	3,908	9,434	-	10,783	38,034	-
944	-	3,540	8,546	-	9,768	34,453	-
494	-	1,852	4,470	-	5,109	18,022	-
12,381	**-**	**46,431**	**112,098**	**-**	**128,126**	**451,934**	**-**
1,450	815	1,214	2,311	1,719	1,228	2,159	295
62,710	35,258	52,527	99,961	74,346	53,139	93,415	12,754
6,968	3,918	5,836	11,107	8,261	5,904	10,379	1,417
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
69,678	**39,175**	**58,363**	**111,068**	**82,606**	**59,044**	**103,794**	**14,171**
369	204	309	587	430	312	549	74
5,821	3,224	4,876	9,279	6,798	4,933	8,671	1,166
1,394	772	1,167	2,222	1,628	1,181	2,076	279
984	545	824	1,568	1,149	834	1,466	197
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
8,199	**4,541**	**6,867**	**13,069**	**9,575**	**6,947**	**12,213**	**1,643**
319	177	268	509	373	271	476	64
4,948	2,741	4,145	7,888	5,779	4,193	7,371	991
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
4,948	**2,741**	**4,145**	**7,888**	**5,779**	**4,193**	**7,371**	**991**

town

-	Access to Natural gas	Access to Natural gas	-	Access to Natural gas	-	Access to Natural gas	Access to Natural gas
RICHMOND	**SHELBURNE**	**SOUTH BURLINGTON**	**ST. GEORGE**	**UNDERHILL**	**WESTFORD**	**WILLISTON**	**WINOOSKI**
1,708	2,787	7,807	293	1,246	823	3,479	2,994
34	56	156	6	25	16	70	60
34	56	156	6	25	16	70	60
649	1,125	3,152	111	503	313	1,405	1,209
991	1,662	4,655	170	743	477	2,074	1,785
85	139	390	15	62	41	174	150
79	129	361	14	58	38	161	139
1,196	1,951	5,465	205	872	576	2,435	2,096
512	836	2,342	88	374	247	1,044	898
612	279	781	105	125	295	348	299
1,947	3,177	8,900	334	1,420	938	3,966	3,413
752	1,227	3,438	129	549	362	1,532	1,319
1,001	1,633	4,576	172	730	482	2,039	1,755
1,032	1,115	3,123	177	498	497	1,392	1,198
1,032	1,115	3,123	177	498	497	1,392	1,198
1,255	2,048	5,738	215	916	605	2,557	2,201
1,580	2,578	7,221	271	1,152	761	3,218	2,769
1,247	1,951	5,465	214	872	601	2,435	2,096
171	279	781	29	125	82	348	299
34	56	156	6	25	16	70	60
1,708	2,787	7,807	293	1,246	823	3,479	2,994
1,742	2,843	7,963	299	1,271	839	3,549	3,054
3,399	5,545	15,534	583	2,479	1,638	6,922	5,957
512	836	2,342	88	374	247	1,044	898
2,361	3,853	10,792	405	1,722	1,138	4,809	4,139
3,089	5,041	14,121	530	2,254	1,489	6,293	5,416
17	28	78	3	12	8	35	30
256	418	1,171	44	187	123	522	449
1,708	2,787	7,807	293	1,246	823	3,479	2,994

ont FINAL, Submitted to :Vermont Department of Public Service, Submitted by: Nexus Market search, Inc., RLW A

UNDERHILL	WESTFORD	WILLISTON	WINOOSKI	Total
1,246	823	3,479	2,994	63,275
77	-	1,926	2,214	35,230
1,169	823	1,553	780	28,045
71,671		1,507,402	1,609,423	26,887,726
7,167	-	150,740	160,942	2,688,773

Access to Natural gas	-	Access to Natural gas	Access to Natural gas	
UNDERHILL	**WESTFORD**	**WILLISTON**	**WINOOSKI**	**Total**
77	-	1,926	2,214	35,230

4,807	-	101,097	107,940	1,803,286
899	-	18,902	20,181	337,151
603	-	12,686	13,545	226,285
546	-	11,492	12,269	204,977
286	-	6,011	6,418	107,219
7,167	**-**	**150,740**	**160,942**	**2,688,773**
1,035	828	1,374	690	25,836
44,755	35,823	59,456	29,862	1,117,657
4,973	3,980	6,606	3,318	124,184
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
49,728	**39,804**	**66,062**	**33,180**	**1,241,841**
263	207	349	176	6,546
4,154	3,276	5,519	2,772	103,387
995	784	1,321	664	24,755
702	554	933	468	17,474
-	-	-	-	-
-	-	-	-	-
5,851	**4,614**	**7,773**	**3,904**	**145,615**
228	180	303	152	5,673
3,532	2,785	4,692	2,356	87,888
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
3,532	**2,785**	**4,692**	**2,356**	**87,889**

	-	-	Access to Natural gas	-	Access to Natural gas	Access to Natural gas
Total	**BOLTON**	**BUELS GORE**	**BURLINGTON**	**CHARLOTTE**	**COLCHESTER**	**ESSEX**
63,275						
1,266	114,200	1,000	3,220,200	346,400	1,410,200	646,200
1,266	11,420	100	322,020	34,640	141,020	64,620
25,409	151,886	1,330	4,551,127	460,712	1,993,044	913,278
37,628	99,354	870	2,879,817	301,368	1,261,138	577,895
3,164	4,996	44	140,884	15,155	61,696	28,271
2,930	40,905	358	1,153,443	124,077	505,120	231,462
44,293	126,239	1,105	3,559,669	382,917	1,558,861	714,321
18,983	51,390	450	1,449,090	155,880	634,590	290,790
7,862	818,181	7,164	6,440,400	2,481,769	2,820,400	1,292,400
72,134	325,470	2,850	9,177,570	987,240	4,019,070	1,841,670
27,867	188,609	1,652	5,318,378	572,103	2,329,040	1,067,243
37,085	50,199	440	1,415,513	152,268	619,886	284,052
26,522	120,709	1,057	2,254,140	366,145	987,140	452,340
26,522	86,221	755	1,610,100	261,532	705,100	323,100
46,507	62,953	551	1,775,135	190,953	777,373	356,218
58,523	57,037	499	1,608,316	173,008	704,319	322,742
44,471	375,147	3,285	10,143,630	1,137,924	4,442,130	2,035,530
6,328	62,525	548	1,763,060	189,654	772,085	353,795
1,266	37,346	327	1,053,086	113,281	461,171	211,324
63,275	701,838	6,146	19,790,343	2,128,866	8,666,649	3,971,343
64,541	145,605	1,275	4,105,755	441,660	1,798,005	823,905
125,900	284,073	2,488	8,009,040	861,670	3,507,344	1,607,180
18,983	85,650	750	2,415,150	259,800	1,057,650	484,650
87,468	157,865	1,382	4,451,453	478,847	1,949,394	893,276
114,453	77,463	678	2,184,290	234,966	956,551	438,323
633	6,578	58	185,484	19,953	81,228	37,221
9,491	11,991	105	338,121	36,372	148,071	67,851
63,275	342,600	3,000	9,660,600	1,039,200	4,230,600	1,938,600
	4,598,449	**40,267**	**110,975,813**	**13,948,361**	**48,598,873**	**22,269,601**
	4,067,392	**14,937**	**85,581,711**	**15,324,571**	**48,696,069**	**24,561,712**

	13%	**170%**	**30%**	**-9%**	**0%**	**-9%**

nalytics, Inc., Dorothy Conant, June 8, 2009", and professional judgment where indicated. ACS 2006: Americar

Electrical consumption by end use and by Town

Access to Natural gas	Access to Natural gas	-	Access to Natural gas	Access to Natural gas	-	Access to Natural gas
ESSEX JUNCTION	**HINESBURG**	**HUNTINGTON**	**JERICHO**	**MILTON**	**RICHMOND**	**SHELBURNE**
927,600	374,400	162,000	383,200	842,200	341,600	557,400
92,760	37,440	16,200	38,320	84,220	34,160	55,740
1,310,982	529,142	215,460	541,579	1,190,286	454,328	787,777
829,550	334,825	140,940	342,695	753,177	297,192	498,481
40,583	16,380	7,088	16,765	36,846	14,945	24,386
332,257	134,106	58,027	137,258	301,668	122,358	199,655
1,025,386	413,869	179,078	423,596	930,984	377,611	616,160
417,420	168,480	72,900	172,440	378,990	153,720	250,830
1,855,200	748,800	1,160,643	766,400	1,684,400	2,447,380	1,114,800
2,643,660	1,067,040	461,700	1,092,120	2,400,270	973,560	1,588,590
1,531,994	618,347	267,554	632,881	1,390,950	564,175	920,584
407,748	164,576	71,211	168,444	370,208	150,158	245,018
649,320	262,080	171,234	268,240	589,540	361,071	390,180
463,800	187,200	122,310	191,600	421,100	257,908	278,700
511,340	206,388	89,303	211,239	464,263	188,307	307,267
463,286	186,993	80,910	191,388	420,633	170,611	278,391
2,921,940	1,179,360	532,170	1,207,080	2,652,930	1,122,156	1,755,810
507,861	204,984	88,695	209,802	461,105	187,026	305,177
303,348	122,438	52,978	125,316	275,420	111,712	182,284
5,700,740	2,300,945	995,601	2,355,027	5,175,898	2,099,367	3,425,606
1,182,690	477,360	206,550	488,580	1,073,805	435,540	710,685
2,307,057	931,180	402,975	953,066	2,094,657	849,730	1,386,323
695,700	280,800	121,500	287,400	631,650	256,200	418,050
1,282,271	517,553	223,941	529,718	1,164,218	472,212	770,524
629,199	253,959	109,886	259,928	571,272	231,710	378,089
53,430	21,565	9,331	22,072	48,511	19,676	32,106
97,398	39,312	17,010	40,236	88,431	35,868	58,527
2,782,800	1,123,200	486,000	1,149,600	2,526,600	1,024,800	1,672,200
31,967,320	**12,902,722**	**6,523,194**	**13,205,991**	**29,024,231**	**13,755,081**	**19,209,341**
31,415,140	**13,698,115**	**5,721,920**	**15,249,432**	**32,653,197**	**13,169,921**	**24,409,693**

2%	**-6%**	**14%**	**-13%**	**-11%**	**4%**	**-21%**

n Community Survey, Census Bureau, 2006Vermont Gas Data 2010

Access to Natural gas	-	Access to Natural gas	-	Access to Natural gas	Access to Natural gas	
SOUTH BURLINGTON	**ST. GEORGE**	**UNDERHILL**	**WESTFORD**	**WILLISTON**	**WINOOSKI**	**Total**
1,561,400	58,600	249,200	164,600	695,800	598,800	12,655,000
156,140	5,860	24,920	16,460	69,580	59,880	1,265,500
2,206,736	77,938	352,196	218,918	983,378	846,287	17,786,384
1,396,356	50,982	222,859	143,202	622,252	535,505	11,288,460
68,311	2,564	10,903	7,201	30,441	26,198	553,656
559,278	20,990	89,261	58,958	249,229	214,484	4,532,895
1,726,001	64,778	275,470	181,952	769,150	661,925	13,989,072
702,630	26,370	112,140	74,070	313,110	269,460	5,694,750
3,122,800	419,837	498,400	1,179,270	1,391,600	1,197,600	31,447,446
4,449,990	167,010	710,220	469,110	1,983,030	1,706,580	36,066,750
2,578,757	96,782	411,571	271,848	1,149,161	988,959	20,900,587
686,349	25,759	109,542	72,354	305,855	263,216	5,562,798
1,092,980	61,940	174,440	173,982	487,060	419,160	9,282,759
780,700	44,243	124,600	124,273	347,900	299,400	6,630,542
860,722	32,303	137,372	90,736	383,560	330,089	6,976,069
779,835	29,268	124,462	82,209	347,515	299,068	6,320,489
4,918,410	192,501	784,980	540,711	2,191,770	1,886,220	40,023,684
854,867	32,084	136,437	90,119	380,951	327,843	6,928,613
510,617	19,164	81,495	53,828	227,544	195,823	4,138,501
9,595,876	360,137	1,531,505	1,011,580	4,276,169	3,680,038	77,773,675
1,990,785	74,715	317,730	209,865	887,145	763,470	16,135,125
3,883,397	145,768	619,792	409,443	1,730,542	1,489,290	31,475,013
1,171,050	43,950	186,900	123,450	521,850	449,100	9,491,250
2,158,406	81,006	344,482	227,535	961,841	827,753	17,493,676
1,059,111	39,749	169,035	111,650	471,967	406,171	8,583,998
89,937	3,375	14,354	9,481	40,078	34,491	728,928
163,947	6,153	26,166	17,283	73,059	62,874	1,328,775
4,684,200	175,800	747,600	493,800	2,087,400	1,796,400	37,965,000
53,809,588	**2,359,625**	**8,588,030**	**6,627,887**	**23,978,936**	**20,636,084**	**443,019,394**
51,222,208	**2,196,267**	**9,727,605**	**6,710,615**	**25,722,336**	**16,339,856**	**426,482,697**

5%	**7%**	**-12%**	**-1%**	**-7%**	**26%**	**4%**

Data type
Electricity

Gas
C&I Non-electric fuels

Vermont Building Type & End Use

Description

C&I electricity data is available from the utilities by town. Efficiency Vermont publishes that data annually on their web page and provides it to the Vermont Energy Atlas. This is a high quality data set

C&I Gas data was obtained from Vermont Gas through personal communication. This is a high quality data set

EIA published total fuel use information on line separated into commercial and industrial. Those tables were pasted on to this tab then added together to get total energy use for the C&I sector. The amount of total energy in Vermont to Chittenden county was distributed according to percent of employees in Chittenden County as compared to Vermont. Also factored into the distribution is that natural gas is only in Chittenden county and the assumption that businesses would choose that over oil as a fuel of choice. This data set has many assumptions.

This table allocates energy use across building type and end use. The data used to disaggregate electric use across buildings and end-uses is from an Efficiency Vermont planning document. For all other fuels, EIA RECS and MECS data was used. The RECS and MECS data is aggregated at the national and New England level so is not Vermont specific. In absence of data, professional judgment was used (and is noted in the spreadsheet). This data set also has many assumptions.

CHITTENDEN COUNTY COMMERCIAL & INDUSTRIAL ENERGY CONSUMPTION and END USE BREAK DOWN

Number of Employees 124098

Total Fuel	TOTAL CONSUMPTION
Electricity (kWh)	775,969,536
Natural Gas (therm)	36,745,856
LP Gas (gallons)	491,266
Oil (gallons)	3,473,227
Kerosene (gallons)	732,064
Wood and Wood Waste (MMBTU)	525,000

Electric (kWh) 2009	All Building Types	Percent	Per Employee
Indoor Lighting	248,545,499	32%	2,003
Outdoor Lighting	27,997,869	4%	226
Cooling	48,767,127	6%	393
Ventilation	108,050,725	14%	871
Water Heating	42,049,939	5%	339
Refrigeration	104,915,881	14%	845
Space Heating	16,509,564	2%	133
Office Equipment	30,853,869	4%	249
Miscellaneous	57,037,236	7%	460
Industrial Process	91,241,826	12%	735
Total	**775,969,536**		

Natural Gas (therms) 2010	All Building Types	Percent	Per Employee
Water Heating	5,174,936	14%	42
Space Heating	24,361,240	66%	196
Miscellaneous	3,051,182	8%	25
Cooking	1,480,994	4%	12
Industrial Process	2,677,504	7%	22
Total	**36,745,856**		

Oil & Kerosene (gallons) 2009	All Building Types	Percent	Per Employee
Water Heating	574,065	14%	5
Space Heating	3,378,148	80%	27
Industrial Process	253,078	6%	2
Total	**4,205,292**		

Propane (gallons) 2009	All Building Types	Percent	Per Employee
Water Heating	69,185	14%	0.6
Space Heating	325,693	66%	2.6
Miscellaneous	40,792	8%	0.3
Cooking	19,800	4%	0.2
Industrial Process	35,796	7%	0.3
Total	**491,266**		

Wood and Wood Waste (MMBTU)	All Building Types	Percent	Per Employee
Heating	525,000	100%	4

Energy	Unit	MMBTU	MMBTU/Employee
Electric (kWh) 2009	775,969,536	2,647,608	21
Natural Gas (therms) 2010	36,745,856	3,674,586	30
Oil & Kerosene (gallons) 2009	4,205,292	581,171	5
Propane (gallons) 2009	491,266	45,000	0.4
Wood and Wood Waste (MMBTU)	525,000	525,000	4

Electric (kWh) 2009				
775969536		13%	13%	2%
	Total	Office	Retail	Grocery
Indoor Lighting	248,545,499	47,331,246	32,913,740	3,355,214
Outdoor Lighting	27,997,869	5,200,728	2,565,614	403,598
Cooling	48,767,127	5,091,979	7,668,874	427,908
Ventilation	108,050,725	12,460,959	26,066,802	661,349
Water Heating	42,049,939	2,014,616	6,696,976	311,878
Refrigeration	104,915,881	709,643	12,101,854	8,817,112
Space Heating	16,509,564	3,111,962	3,021,271	64,027
Office Equipment	30,853,869	13,686,065	2,678,599	138,702
Miscellaneous	57,037,236	9,790,806	3,836,726	231,074
Cooking	0	-	-	-
Industrial Process	91,241,826	-	-	-
Total	775,969,536	99,398,002	97,550,456	14,410,863

Natural Gas (therms) 2010				
36,745,856		13%	13%	2%
		Office	Retail	Grocery
Indoor Lighting	0	0	0	0
Outdoor Lighting	0	0	0	0
Cooling	0	0	0	0
Ventilation	0	0	0	0
Water Heating	5,174,936	227,474	332,463	34,996
Refrigeration	0	0	0	0
Space Heating	24,361,240	4,024,546	3,289,629	472,447
Office Equipment	0	0	0	0
Miscellaneous	3,051,182	402,455	577,435	34,996
Cooking	1,480,994	52,494	419,953	139,984
Industrial Process	2,677,504	0	0	0
Total	36,745,856	4,706,969	4,619,479	682,423

Oil & Kerosene (gallons) 2009				
3,473,227		13%	13%	2%
		Office	Retail	Grocery
Indoor Lighting	0	0	0	0
Outdoor Lighting	0	0	0	0
Cooling	0	0	0	0
Ventilation	0	0	0	0
Water Heating	574,065	23,801	40,078	4,448
Refrigeration	0	0	0	0
Space Heating	2,646,083	421,102	396,557	60,054

Office Equipment	0	0	0	0
Miscellaneous	0	0	0	0
Cooking	0	0	0	0
Industrial Process	253,078	0	0	0
Total	3,473,227	444,904	436,634	64,503

Propane (gallons) 2009				
	491,266	13%	13%	2%
		Office	Retail	Grocery
Indoor Lighting	0	0	0	0
Outdoor Lighting	0	0	0	0
Cooling	0	0	0	0
Ventilation	0	0	0	0
Water Heating	69,185	3,041	4,445	468
Refrigeration	0	0	0	0
Space Heating	325,693	53,805	43,980	6,316
Office Equipment	0	0	0	0
Miscellaneous	40,792	5,381	7,720	468
Cooking	19,800	702	5,614	1,871
Industrial Process	35,796	0	0	0
Total	491,266	62,929	61,759	9,124

6%	13%	12%	10%	2%	15%
Warehouse	Education	Health	Lodging	Restaurant	Other Commercial
9,336,448	49,265,959	31,726,733	25,971,659	3,208,434	34,288,046
1,631,154	5,144,958	2,151,085	5,395,899	933,403	4,571,430
294,885	3,639,060	7,275,718	3,999,775	559,306	5,619,284
5,237,990	20,426,353	10,076,353	19,534,049	1,167,249	12,419,622
334,246	7,031,777	7,143,216	8,680,200	2,607,098	7,229,931
29,274,377	2,446,865	3,528,942	2,761,029	5,115,451	40,160,608
500,861	2,278,897	2,020,144	3,990,494	127,544	1,394,365
770,899	4,696,911	2,195,597	3,313,235	150,414	3,223,447
1,394,368	4,097,713	23,672,973	5,798,161	541,965	7,673,452
-	-	-	-	-	-
-	-	-	-	-	-
48,775,228	99,028,493	89,790,761	79,444,500	14,410,863	116,580,185

6%	13%	12%	10%	2%	15%
Warehouse	Education	Health	Lodging	Restaurant	Other Commercial
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
69,992	647,427	1,294,854	2,169,755	188,255	126,911
0	0	0	0	0	0
1,942,281	3,622,092	2,379,732	1,119,874	181,531	4,568,795
0	0	0	0	0	0
297,466	332,463	402,455	227,474	6,723	769,715
0	87,490	174,980	244,972	305,914	55,206
0	0	0	0	0	0
2,309,740	4,689,471	4,252,020	3,762,076	682,423	5,520,627

6%	13%	12%	10%	2%	15%
Warehouse	Education	Health	Lodging	Restaurant	Other Commercial
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
7,594	67,214	141,623	234,540	32,838	14,103
0	0	0	0	0	0
210,723	376,036	260,279	121,053	31,665	507,708

0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
	0	0	0	0	0	0
	218,317	443,250	401,902	355,592	64,503	521,811

6%	13%	12%	10%	2%	15%
Warehouse	Education	Health	Lodging	Restaurant	Other Commercial
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
936	8,656	17,311	29,008	2,517	1,697
0	0	0	0	0	0
25,967	48,425	31,815	14,972	2,427	61,082
0	0	0	0	0	0
3,977	4,445	5,381	3,041	90	10,291
0	1,170	2,339	3,275	4,090	738
0	0	0	0	0	0
30,880	62,695	56,847	50,296	9,124	73,807

	Electric		
15%			
Industrial	Office	Retail	Grocery
11,148,020	48%	34%	23%
-	5%	3%	3%
14,190,340	5%	8%	3%
-	13%	27%	5%
-	2%	7%	2%
-	1%	12%	61%
-	3%	3%	0%
-	14%	3%	1%
-	10%	4%	2%
-	0%	0%	0%
91,241,826	0%	0%	0%
116,580,185	1	1	1

	Natural Gas		
15%			
Industrial	Office	Retail	Grocery
0	0%	0%	0%
0	0%	0%	0%
0	0%	0%	0%
0	0%	0%	0%
82,809	5%	7%	5%
0	0%	0%	0%
2,760,314	86%	71%	69%
0	0%	0%	0%
0	9%	13%	5%
0	1%	9%	21%
2,677,504	0%	0%	0%
5,520,627	1	1	1

	Oil		
15%			
Industrial	Office	Retail	Grocery
0			
0			
0			
0			
7,827	5%	9%	7%
0			
260,906	95%	91%	93%

0			
0			
0			
253,078			
521,811	1	1	1

	Propane		
15%			
Industrial	Office	Retail	Grocery
0	0%	0%	0%
0	0%	0%	0%
0	0%	0%	0%
0	0%	0%	0%
1,107	5%	7%	5%
0	0%	0%	0%
36,903	86%	71%	69%
0	0%	0%	0%
0	9%	13%	5%
0	1%	9%	21%
35,796	0%	0%	0%
73,807			

Warehouse	Education	Health	Lodging	Restaurant
19%	50%	35%	33%	22%
3%	5%	2%	7%	6%
1%	4%	8%	5%	4%
11%	21%	11%	25%	8%
1%	7%	8%	11%	18%
60%	2%	4%	3%	35%
1%	2%	2%	5%	1%
2%	5%	2%	4%	1%
3%	4%	26%	7%	4%
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
1	1	1	1	1

Warehouse	Education	Health	Lodging	Restaurant
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
3%	14%	30%	58%	28%
0%	0%	0%	0%	0%
84%	77%	56%	30%	27%
0%	0%	0%	0%	0%
13%	7%	9%	6%	1%
0%	2%	4%	7%	45%
0%	0%	0%	0%	0%
1	1	1	1	1

Warehouse	Education	Health	Lodging	Restaurant
3%	15%	35%	66%	51%
97%	85%	65%	34%	49%

1	1	1	1	1

Warehouse	Education	Health	Lodging	Restaurant
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
0%	0%	0%	0%	0%
3%	14%	30%	58%	28%
0%	0%	0%	0%	0%
84%	77%	56%	30%	27%
0%	0%	0%	0%	0%
13%	7%	9%	6%	1%
0%	2%	4%	7%	45%
0%	0%	0%	0%	0%

Other Commercial	Industrial
29%	10%
4%	0%
5%	12%
11%	0%
6%	0%
34%	0%
1%	0%
3%	0%
7%	0%
0%	0%
0%	78%
1	1

Office	Retail	Grocery	Warehouse	Education	Health
292,708	77,521	52,332	9,338	137,625	50,686
32,163	6,043	6,295	1,631	14,373	3,437
31,490	18,062	6,674	295	10,166	11,624
77,061	61,395	10,315	5,239	57,061	16,098
12,459	15,773	4,864	334	19,643	11,412
4,389	28,503	137,523	29,280	6,835	5,638
19,245	7,116	999	501	6,366	3,227
84,638	6,309	2,163	771	13,121	3,508
60,549	9,037	3,604	1,395	11,447	37,820
0	0	0	0	0	0
614,701	229,760	224,770	48,785	276,638	143,449

Source: Internal VEIC document used for planning

Other Other Commercial	Industrial
0%	0%
0%	0%
0%	0%
0%	0%
2%	2%
0%	0%
83%	50%
0%	0%
14%	
1%	
0%	49%
1	1

Other Commercial	Industrial
3%	2%
	0%
97%	50%

	0%
	49%
1	1

Other Other Commercial	Industrial
0%	0%
0%	0%
0%	0%
0%	0%
2%	2%
0%	0%
83%	50%
0%	0%
14%	0%
1%	0%
0%	49%

Lodging	Restaurant	Other Commercial	Industrial
30,230	17,269	93,201	132,477
6,281	5,024	12,426	0
4,656	3,010	15,274	168,631
22,737	6,283	33,759	0
10,103	14,033	19,652	0
3,214	27,534	109,164	0
4,645	687	3,790	0
3,856	810	8,762	0
6,749	2,917	20,858	0
0	0	0	1,084,270
92,470	77,567	316,887	1,385,378

-

Conversions	
Oil - BTU per gallon	138,200
Natural Gas - BTU per therm	100,000
LPG - BTU per gallon	91,600
Kerosene - BTU per gallon	136,600
Trillion BTU - BTU	#########

Non-Transportation Fossil Fuels. Source: EIA. Data is 2009 for all of Vermont

Industrial - All Vermont

http://205.254.135.24/state/seds/hf.jsp?incfile=sep_use/ind/use_ind_VT.html&mstate=Vermont

2009	Petroleum							Wood and waste
	Distillate Fuel Oil	Kerosene	LPG	Motor Gasoline c	Residual Fuel Oil	Other [d]	Total	
trillion BTU	3.2		0.3	0.6	0.7	0.3	5.1	1.5
BTU	3,200,000,000,000		#########	#########	#########	#########	#########	###############
Therm								
Gallons	23,154,848		3,275,109		5,065,123			

Commercial - All Vermont

http://www.eia.gov/state/seds/hf.jsp?incfile=sep_sum/html/sum_btu_com.html

2009	Petroleum							Wood and waste
	Distillate Fuel Oil	Kerosene	LPG	Motor Gasoline c	Residual Fuel Oil	Other [d]	Total	
trillion BTU	4.2	0.1	2.7	2.7	0	0.6	7.6	0.6
BTU	4,200,000,000,000	100,000,000,000	#########	#########	-	#########	#########	600,000,000,000
Therm								
Gallons	30,390,738	732,064	29,475,983	19,536,903				

Total C&I - All Vermont

2009	Petroleum							Wood and waste
	Distillate Fuel Oil	Kerosene	LPG	Motor Gasoline c	Residual Fuel Oil	Other [d]	Total	
Trillion BTU								2
Therm	-		-	-	-	-	-	-
Gallons	53,545,586	732,064	32,751,092	19,536,903	5,065,123	-	-	-

Total C&I - Chittenden County

2009	Petroleum							Wood and waste
	Distillate Fuel Oil	Kerosene	LPG	Motor Gasoline c	Residual Fuel Oil	Other [d]	Total	
Percent in Chittenden County	15%	20%	15%		15%			0.25
MMBTU								525,000.00
Therm								
Gallons	3,473,227	732,064	491,266		759,768			

Electric and Gas. Source: Efficiency Vermont and Vermont Gas. Data is 2010 for gas 2009 for electric and is Chittenden County Specific

	Electric			Gas	
Chittenden County Cities and Towns	kWh Usage: Commercial & Industrial Sector	**kWh Usage:** Residential Sector	**Savings:** Commercial & Industrial	**Number of accounts**	**Gas 2010 Therms**
BOLTON	2,767,796	4,067,392	85,037		
BUELS GORE	0	14,937	0		
BURLINGTON	261,050,319	85,581,711	3,683,000	1282	########
CHARLOTTE	3,012,041	15,324,571	20,892		
COLCHESTER	80,126,375	48,696,069	1,212,452	455	3,529,622
ESSEX	37,461,060	24,561,712	1,581,553		
ESSEX JUNCTION	28,075,265	31,415,140	4,772,578	580	8,514,313
HINESBURG	7,256,471	13,698,115	258,417	24	33,408
HUNTINGTON	594,277	5,721,920	(456)		
JERICHO	5,702,759	15,249,432	17,759	17	44,175
MILTON	32,025,718	32,653,197	846,203	152	675,469
RICHMOND	5,385,400	13,169,921	35,254		
SHELBURNE	25,780,694	24,409,693	672,180		667,962
SOUTH BURLINGTON	174,124,180	51,222,208	2,695,287	1048	5,618,933
ST. GEORGE	466,903	2,196,267	0		
UNDERHILL	1,234,136	9,727,605	1,568	4	1,902
WESTFORD	609,653	6,710,615	9,540		
WILLISTON	84,945,422	25,722,336	1,558,980	763	3,161,143
WINOOSKI	25,817,970	16,339,856	757,105	200	928,463
	775,969,536	195,204,863.0			########

Gas data: personal communication with VGS
Electric data: http://www.efficiencyvermont.com/about_us/energy_initiatives/vt_town_energy.aspx

Natural Gas End Use Distribution. Source: EIA. Data is 2003 and is National and New England

Released: September, 2008

Table E7A. Natural Gas Consumption (Btu) and Energy Intensities by End Use for All Buildings, 2003

	Total Natural Gas Consumption (trillion Btu)									
	Total	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**	**Total**	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**
Principal Building Activity										
Education	268	207	37	5	19	38.1	29.5	5.2	0.7	2.7
Food Sales	39	27	2	8	Q	51.7	35.6	3.2	11.2	Q
Food Service	203	54	56	91	Q	145.6	39.0	40.0	65.4	Q
Health Care	243	136	74	10	23	95.3	53.6	28.9	3.8	9.1
Inpatient	204	103	71	9	21	113.2	56.8	39.4	5.2	11.9
Outpatient	38	34	3	Q	Q	51.8	45.6	3.5	Q	Q
Lodging	215	64	124	14	Q	50.4	15.0	29.2	3.3	Q
Mercantile	264	188	19	24	33	33.5	23.9	2.4	3.1	4.1
Retail (Other Than Mall)	91	84	3	3	2	31.9	29.3	1.0	0.9	0.7
Enclosed and Strip Malls	172	104	16	22	31	34.4	20.9	3.1	4.3	6.1

	Total Natural Gas Consumption Percent				
	Total	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**
Education	100.000%	77%	14%	2%	7%
Food Sales	100.000%	69%	5%	21%	5%
Food Service	100.000%	27%	28%	45%	1%
Health Care	100.000%	56%	30%	4%	9%
Inpatient	100.000%	50%	35%	4%	10%
Outpatient	100.000%	89%	8%	1%	2%
Lodging	100.000%	30%	58%	7%	6%
Mercantile	100.000%	71%	7%	9%	13%
Retail (Other Than Mall)	100.000%	92%	3%	3%	1%
Enclosed and Strip Malls	100.000%	60%	9%	13%	17%

Office	269	230	13	3	23	32.8	28.1	1.6	0.3	2.8
Public Assembly	102	92	2	3	Q	37.5	33.8	0.9	1.0	Q
Public Order and Safety	29	15	10	Q	Q	45.0	24.1	15.1	Q	Q
Religious Worship	82	77	2	3	Q	31.2	29.1	0.9	1.0	Q
Service	139	119	2	Q	17	55.8	47.8	0.9	Q	Q
Warehouse and Storage	132	111	4	Q	Q	24.1	20.2	0.7	Q	Q
Other	87	72	2	Q	12	69.7	57.9	1.7	Q	9.4
Vacant	28	26	Q	Q	Q	23.7	22.0	Q	Q	Q

100.000%	86%	5%	1%	9%
100.000%	90%	2%	3%	5%
100.000%	52%	34%	1%	13%
100.000%	94%	2%	4%	0%
100.000%	86%	1%	1%	12%
100.000%	84%	3%	0%	13%
100.000%	83%	2%	1%	14%
100.000%	93%	7%	0%	0%

	Total Natural Gas Consumption (trillion Btu)									
	Total	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**					
Census Region and Division										
Northeast	462	332	51	34	45	45.5	32.7	5.1	3.3	4.4
New England	87	69	Q	Q	5	46.8	36.9	4.3	2.8	2.9
Middle Atlantic	375	263	44	29	39	45.2	31.7	5.2	3.5	4.7
Midwest	751	589	82	32	47	53.1	41.7	5.8	2.3	3.3
East North Central	567	452	62	23	30	54.8	43.7	6.0	2.2	2.9
West North Central	184	137	20	9	Q	48.5	36.2	5.4	2.4	4.5
South	527	291	129	68	38	34.5	19.1	8.4	4.5	2.5
South Atlantic	246	132	60	32	22	33.7	18.1	8.2	4.4	3.0
East South Central	107	69	25	8	5	42.6	27.4	10.0	3.3	1.8
West South Central	174	90	44	28	12	31.8	16.5	8.0	5.1	2.2
West	360	208	85	29	38	40.5	23.4	9.6	3.3	4.3
Mountain	190	132	35	6	17	58.4	40.5	10.8	2.0	5.1
Pacific	170	76	50	23	21	30.1	13.5	8.9	4.0	3.8

Total Natural Gas Consumption (trillion Btu)				
Total	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**
1	79%	10%	5%	6%

(*)=Value rounds to zero in the units displayed.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, C, and E of the 2003 Commercial Buildings Energy Consumption Survey.

http://www.eia.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html

Natural Gas End Use Distribution. Source: EIA. Data is 2003 for New England

Released: September, 2008

Table E10A. Fuel Oil Consumption (gallons) and Energy Intensities by End Use for

	(million gallons)				
	Total	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**
Census Region and Division					
Northeast	1,302	1,153	111	Q	30
New England	531	490	35	1	4
Middle Atlantic	771	663	Q	Q	26
Midwest	172	Q	4	Q	10
East North Central	Q	Q	Q	Q	Q
West North Central	Q	Q	Q	Q	Q
South	107	73	Q	Q	25
South Atlantic	96	69	Q	Q	21

Percent in New England

Total	**Space Heating**	**Water Heating**	**Cook-ing**	**Other**
0.9	0.1	0.0	0.0	0.0

East South Central	7	3	(*)	2	1
West South Central	5	1	Q	(*)	3
West	64	Q	Q	Q	7
Mountain	Q	Q	Q	Q	Q
Pacific	29	15	Q	(*)	5

CBECS web site - http://www.eia.doe.gov/emeu/cbecs.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, C, and E of the 2003

http://www.eia.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html

Building Categories

Categories we're using	Categories from CBECs					
Office	Office					
Retail	Mercantile	##########	##########			
Grocery	Food Sales					
Warehouse	##########					
Education	Education					
Health	Health Care	##########	##########			
Lodging	Lodging					
Restaurant	Food Service					
Other Commercial	Public Assembly	##########	##########	##########	##########	##########
Street Lights						
Industrial						

Number of Employees. Source: Woods and Poole. Data is 2009 and Chittenden County Specific

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
TOTAL POPULATION (in thous	96.16	99.76	102.365	104.314	104.141	104.941	106.206	107.875	109.73	111.3	113.127	116.026	117.336	118.43	119.853	120.774
TOTAL NUMBER of HOUSEHO	26.507	27.848	29.013	30.202	30.746	31.409	32.358	33.399	34.337	35.29	36.769	38.716	39.493	40.005	40.668	41.487
TOTAL EMPLOYMENT (in thou	47.54	49.428	49.337	49.74	50.784	51.338	51.064	53.763	56.326	61.44	65.109	67.03	69.954	71.49	73.519	77.321

Source: CCRPC

	Distribution between building types
	2,100
100%	13%
95%	2%
99%	10%
100%	12%
100%	10%
98%	2%
94%	10%
88%	13%
99%	4%
83%	8%

91%	13%
95%	5%
87%	1%
100%	4%
88%	7%
87%	6%
86%	4%
100%	1%

1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
122.338	123.807	125.375	128.3	130.686	132.143	132.996	134.042	135.985	138.442	140.104	141.239	142.729	143.758	145.379	147.07	147.979	148.795	149.093	149.712	149.983
42.457	43.501	44.477	46.183	47.744	48.594	49.185	49.971	50.698	51.403	52.432	53.592	54.546	55.327	55.912	56.706	57.197	57.66	57.96	58.388	58.672
82.05	85.713	89.717	95.261	98.872	98.937	96.858	97.979	100.05	102.594	104.478	107.375	109.075	111.715	114.159	118.524	120.008	119.087	119.354	121.528	122.241

2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
150.257	150.698	151.367	152.313	154.265	156.215	158.182	160.164	162.162	164.17	166.188	168.218	170.255	172.299	174.348	176.407	178.474	180.543	182.619	184.694	186.767
58.969	59.35	59.849	60.478	60.825	61.679	62.693	63.7	64.701	65.693	66.674	67.643	68.599	69.544	70.48	71.408	72.325	73.226	74.114	74.987	75.846
122.89	124.336	125.636	124.098	123.862	127.2	128.837	130.496	132.169	133.864	135.579	137.312	139.062	140.832	142.62	144.43	146.256	148.103	149.97	151.854	153.762

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
188.844	190.92	192.997	195.07	197.142	199.213	201.287	203.365	205.445	207.523	209.606	211.691	213.781	215.869
76.692	77.524	78.344	79.153	79.951	80.737	81.511	82.273	83.02	83.75	84.466	85.166	85.85	86.519
155.685	157.628	159.593	161.576	163.576	165.598	167.642	169.702	171.783	173.884	176.005	178.146	180.308	182.488