Economic Information on Energy Consumption and Production in Chittenden County

July 12, 2012

Appendix to the Energy Report

An Analysis of economic factors playing a role in Energy Production and Use in Chittenden County.

ENVIRONMENT | COMMUNITY | OPPORTUNITY | SUSTAINABILITY
A SUSTAINABLE FUTURE FOR CHITTENDEN COUNTY

Table of Contents

Introduction:

Other ECOS reports cover the state of the economy in Chittenden County, with a focus on demographics, employment, businesses, income, GDP, housing, and competitiveness. This section is provided as a complement to the Energy report and touches on the economic aspects of energy consumption and production in Chittenden County.

Energy costs are affected by market demand and supply factors that Chittenden County residents have very little control over. Higher energy costs in recent years and forecast for the near future raise the awareness of our dependency on increasingly expensive energy. Planners are aware of the economic cost of energy and the 2011 Vermont Comprehensive Energy Plan lists *fostering economic security and independence* as the first key benefit resulting from achieving the plan's energy goal. A greater awareness of the cost of energy can help raise awareness of the need to use less energy through using more efficient equipment, through conservation behaviors, and by switching to less costly fuels and more sustainable fuel sources. The economics of energy can be approached at different levels. Demand and supply for fuels are key influencers of how energy is consumed. Demand and supply are not static and change with time and factors affecting supply can be both local and global, and are subject to world events as well as re-negotiation of local contracts. In this report we discuss sector-level energy trends and forecasts, market transformation, and the importance of policy and investment decisions.

In this report, price is presented per unit of energy (British Thermal Unit, BTU), to allow for comparisons while accounting for different energy yields in different fuels (i.e. the number of BTU is not the same per gallon of gasoline, per oil barrel, per ccf natural gas, or per cord of wood). While the reader may be more familiar with other units, these do not allow for valid comparisons and are only used in very specific instances. A conversion table is provided in Appendix A.

Energy is Expensive, Costs Will Rise

Current Expenditure on Energy

Compared to the national average, a larger percentage of Vermonters and Chittenden County resident's income is spent on energy costs—particularly for home heating and transportation.[1]

With limited energy production located in the county, a large proportion of the funds leave the county without contributing to the local economy. The remaining funds support fuel and electricity distributors, provide local jobs, and income for the county's residents.

It has been estimated that Vermont currently spends $2.5 billion on energy annually.[2] The largest of the primary fuels was used for transportation. Assuming that Chittenden County accounts for 25-33% of the state total (as a percentage of population and employees), Chittenden County is estimated to spend between $625 and $750 million on energy every year.

[1] 2011 Vermont Comprehensive Energy Plan

[2] 2011 Vermont Comprehensive Energy Plan, 2009 data.

Using the assumptions listed in the section "consumption by End-use" section of this report (Appendix B), we calculated that, in Chittenden County, about $147 million was spent non-transportation residential energy, $169 million on residential and commercial transportation, and $301 million on commercial and industrial non-transportation energy. In total, $617 billion was spent on energy in Chittenden County in 2009 (25% of Vermont's total).

Table 1 to Table 4 show the total energy consumption in the County, as well as that total consumption divided by the total number of households or employees in the county. The per-household or per-employee consumption/ expenditure represent the average that a customer would consume or spend if they used a combination of multiple fuels proportional to the fuel mix used countywide. For example, if we look at three households where two household use 1000 therms of natural gas and one household uses 500 gallons of oil, on average each home would use 333 therms of natural gas and 167 gallons of oil. The tables do not report the disaggregation by fuel type of the average consumption/ expenditure of a typical household or employee (see full ECOS Energy Report and Appendix for more details). For example, natural gas is widely used in Chittenden County; therefore the consumption and expenditure appear higher for natural gas than for other fuels. However, this is solely due to the prevalence of natural gas in Chittenden County.

Table 1: Chittenden County residential non-transportation expenditure on energy

Residential					
Electricity, heat, and hot water	**Total MMBTU annual consumption**[3]	**Per household MMBTU annual consumption**[4]	**Cost per MMBTU (2009)**[5]	**Total Chittenden County Annual Expenditure (2009)**	**Per Household Average Annual Expenditure (2009)**
Electricity	1,455,159	23	$41.35	$60,170,825	$951
Oil	1,241,841	20	$21.70	$26,947,950	$434
Natural Gas	2,688,773	42	$20.00	$53,775,460	$840
Wood [6]	87,889	1	$16.99	$1,493,234	$17
Propane	145,615	2	$33.16	$4,828,593	$66
Total	**5,682,552**	**89**		**$147,216,062**	**$2,308**

3 From Appendix B of ECOS Energy report
4 Ibid.
5 Vermont Fuel Price Report (Sept 2009), petroleum fuel prices have gone up since 2009
6 Average of green cordwood ($14.39) and wood pellets ($19.59)

Table 2: Chittenden County commercial and industrial non-transportation expenditure on energy

Commercial and Industrial					
Electricity, heat, and hot water	**Total MMBTU annual consumption**	**Per employee MMBTU annual consumption**	**Cost per MMBTU (2009)[7]**	**Total Chittenden County Annual Expenditure (2009)**	**Per employee Average Annual Expenditure (2009)**
Electricity	2,840,787	30	$41.35	$117,466,532	$1,260
Oil	2,330,530	25	$21.70	$50,572,512	$542
Natural Gas	4,526,017	49	$20.00	$90,520,338	$ 971
Wood [8]	661,367	7	$16.99	$11,236,621	$120
Propane	944,810	10	$33.16	$31,329,888	$ 336
Total	**11,303,511**	**121**		**$301,125,891**	**$3,229**

Table 3: Chittenden County expenditure on transportation fuel

Transportation					
	Total gallon annual consumption	**Per capita annual gallon consumption**	**Cost per gallon (2009)[9]**	**Total Chittenden County Annual Expenditure (2009 $)**	**Per capita Average Annual Expenditure (2009 $)**
Motor Gasoline[10]	64,035,444	420	2.64	$169,053,572	$1,108[11]

[7] Vermont Fuel Price Report (Sept 2009)

[8] Average of green cordwood ($14.39) and wood pellets ($19.59)

[9] Vermont Fuel Price Report (Sept 2009)

[10] includes fuel ethanol blended into motor gasoline, 64,035,444 gallon of gasoline in Chittenden County (County data from the Vermont Transportation Energy Report)/331,800,000 gallon gasoline in Vermont (EIA 2009 data)= 19.3%. Other fuels (natural gas, biofuels, electricity, are currently used in small, difficult to estimate quantities.

[11] Cost would be $1,440 using December 2011 price per gallon of $3.43, and $1,680 at $4.00 per gallon

Table 4: Expenditure by sector in Vermont and Chittenden County

	2009 Expenditure in Vermont (billions $) [12]		2009 Expenditure in Chittenden County (million $)[13]	
Transportation	$1,018.80 [14]	41%	$169.05	27%
Residential	$814.70	33%	$147.21	24%
Commercial	$431.40	17%	$301.12	49%
Industrial	$236.80	9%		
Total	***$2,501.70***	***100%***	***$617.38***	***100%***

Compared to the rest of the Nation, Vermont (and Chittenden County) pays relatively higher rates for energy than the US average (Table 5).[15] Natural Gas is primarily available in Chittenden County and therefore natural gas prices in the county are not expected to differ from the State's average.

Table 5: Price of fuels in Chittenden County, Vermont and the US, 2011

	Chittenden County/ Vermont	US Average
Natural Gas		
City Gate[16]	$7.11/thousand cu ft	$5.24/thousand cu ft
Residential	$17.56/thousand cu ft	$10.59/thousand cu ft
Electricity		
Residential	16.62 cents/kWh	11.88 cents/kWh
Commercial	14.13 cents/kWh	10.06 cents/kWh
Industrial	10.10 cents/kWh	6.60 cents/kWh
Transportation		
Gasoline	$3.43 /gallon	$3.27 /gallon

Trends and Forecast

Historical trends

The inflation-adjusted price per unit of energy (British Thermal Unit, or BTU) of most fuels, except electricity, has gone up in Vermont since 1990 (Figure 1 and Table 6). [17] The increase in prices per BTU occurred essentially in the last decade. Electricity remains the most costly fuel per BTU, but petroleum sources are catching up. The trends are adjusted for inflation, which means that overall electricity prices have increased less over the years than the prices of a mix of other common goods, whereas other fuels

[12] EIA data in 2011 Vermont Comprehensive Energy Plan, Exhibit 2-17

[13] Calculated for Chittenden County using End-use Consumption Estimates

[14] These expenditures are only for **taxable** gas and diesel sales so they don't include any school, municipal or non-profit transportation services.

[15] EIA: http://205.254.135.24/state/state-energy-profiles-data.cfm?sid=VT#Prices, November 2011

[16] The points of delivery between the interstate pipelines and the local distribution company.

[17] 2011 Vermont Comprehensive Energy Plan, Data Source: EIA, DPS calculation

have increased more. Biomass remains the cheapest (per BTU) of all the commonly used heating fuels (Table 7).

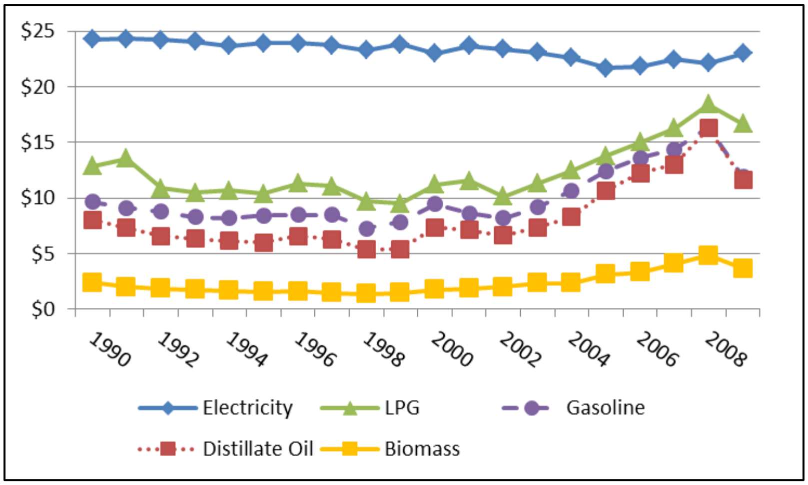


Figure 1: Inflation-Adjusted Energy Source Prices (in 1990 $ per million Btu)

Table 6: Annual Growth Rate of Inflation-Adjusted Energy Source Prices, 1990–2009

Energy Source	% Growth Rate
Biomass	1.7
Liquefied Petroleum Gas (Propane)	1.3
Gasoline	1.0
Distillate Oil	1.9
Electricity	–0.3

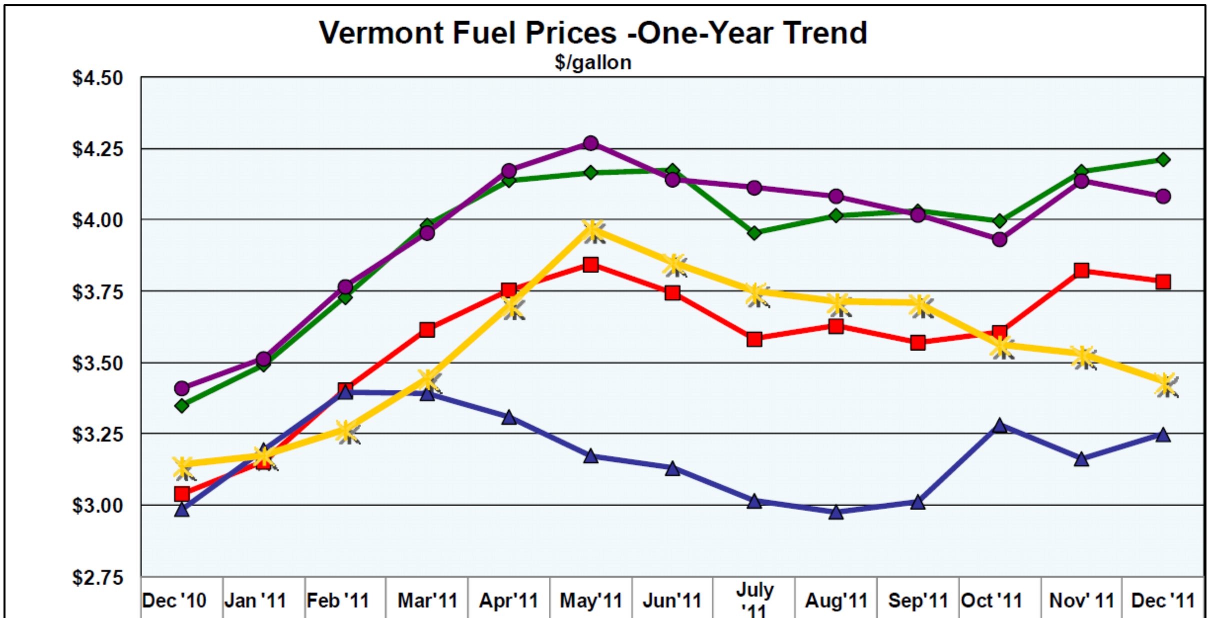
Table 7: Cost of heating fuels in Vermont in 2011[18]

Comparing the Cost of Heating Fuels				
Type of Energy	BTU/unit	Adj Effic	$/unit	$/MMBtu
Fuel Oil, gallon	138,200	80%	$3.78	$34.22
Kerosene, gallon	136,600	80%	$4.21	$38.54
Propane, gallon	91,600	80%	$3.25	$44.32
Natural Gas, therm	100,000	80%	$1.67	$20.83
Electricity, kwh	3,412	100%	$0.15	$43.46
Wood, cord (green)	22,000,000	60%	$190.00	$14.39
Pellets, ton	16,400,000	80%	$247.00	$18.83

* The natural gas price is based on the rate effective 10/22/11
*Wood green updated 11/16/11

[18] The Vermont Fuel Price Report is published monthly by the Vermont Department of Public Service. http://publicservice.vermont.gov/pub/fuel-price-report/11Dec.pdf

Petroleum based fuels prices are very volatile and the price of these fuels varies greatly over just one year (Figure 2). This price volatility puts additional financial stress on people with low or with fixed-income and on people who have no other options but to drive a car a long distance to get to work or access needed services and goods as well as recreational opportunities. Some argue that there is a direct link between the transportation costs associated with a neighborhood and its foreclosure rate,[19] directly linking higher gasoline prices with foreclosures during the recent downturn of the economy.



	Dec '10	Jan '11	Feb '11	Mar'11	Apr'11	May'11	Jun'11	July '11	Aug'11	Sep'11	Oct '11	Nov' 11	Dec '11
#2 Fuel Oil	$3.04	$3.15	$3.40	$3.62	$3.75	$3.84	$3.74	$3.58	$3.63	$3.57	$3.60	$3.82	$3.78
Kerosene	$3.35	$3.49	$3.73	$3.98	$4.14	$4.17	$4.17	$3.95	$4.02	$4.03	$4.00	$4.17	$4.21
Propane	$2.99	$3.19	$3.40	$3.39	$3.31	$3.17	$3.13	$3.02	$2.98	$3.01	$3.28	$3.16	$3.25
Gasoline	$3.14	$3.17	$3.27	$3.44	$3.70	$3.97	$3.85	$3.75	$3.71	$3.71	$3.56	$3.53	$3.43
Diesel	$3.41	$3.51	$3.77	$3.95	$4.17	$4.27	$4.14	$4.11	$4.08	$4.02	$3.93	$4.14	$4.08

Figure 2: Short term fuel price trends in Vermont[20]

Directly or indirectly, the cost of energy is related to the size and growth of the economy. Generally business growth is correlated with growth in number of employees and increase in energy use. Overall, approximately 10% of Vermont's GDP is consumed by the energy sector (Figure 3). [21] The share of state GDP attributed to energy rose from 9.4% in 1990 to 10.4% in 2009. This increase is attributable to the increased cost of energy fuels (other than electricity). In 2008, the spike in oil prices increased the state's energy bill to 12.3% of GDP, a 20-year high. A similar increase of the share of Chittenden County's

[19] NRDC report on Location Efficiency http://www.nrdc.org/media/2010/100127.asp
[20] The Vermont Fuel Price Report is published monthly by the Vermont Department of Public Service. http://publicservice.vermont.gov/pub/fuel-price-report/11Dec.pdf
[21] 2011 Vermont Comprehensive Energy Plan, Data source: EIA and the U.S. Bureau of Economic Analysis

GDP[22] can be expected if the price of fuels increases in the future, as predicted and decried in the next section of this report.

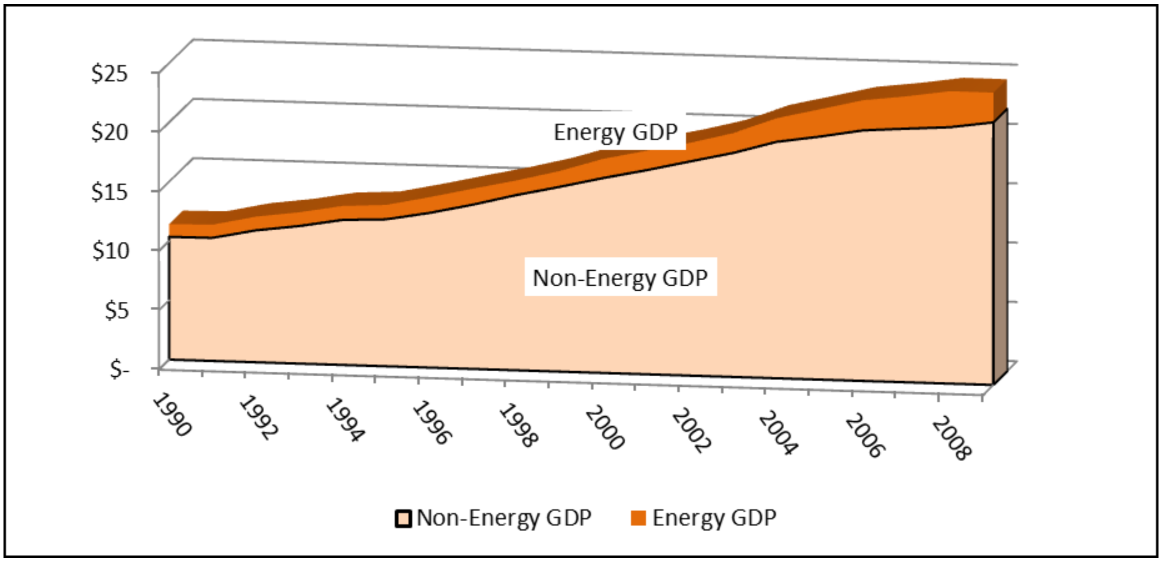


Figure 3: Share of Vermont's GDP consumed by the energy sector

Forecast

National prices of most fuels (in real dollars, i.e. adjusted for inflation) are expected to increase over the next 20 years (Figure 4).[23] While there are some regional differences, prices of fossil fuels in Chittenden County are expected to increase at a similar rate as nationally. The trends presented below represent averages and certain fuel types are more subject to market forces and volatility than others, with oil costs being perhaps the most volatile. The price of electricity on the other hand is not expected to increase at the national level. The next section takes a closer look at the regional electricity market and discusses factors that will affect the price of electricity in Chittenden County.

[22] GDP has often been criticized as not being truly representative of the actual economic development of a region and is solely presented here as an illustration of the importance of energy on the county's economy. There are no estimates of GDP by county available from the US Department of Commerce Bureau of Economic Analysis (BEA).

[23] EIA data, Report Annual Energy Outlook 2011, Scenario ref2011, Reference case Datekey d020911a, Release Date April 2011

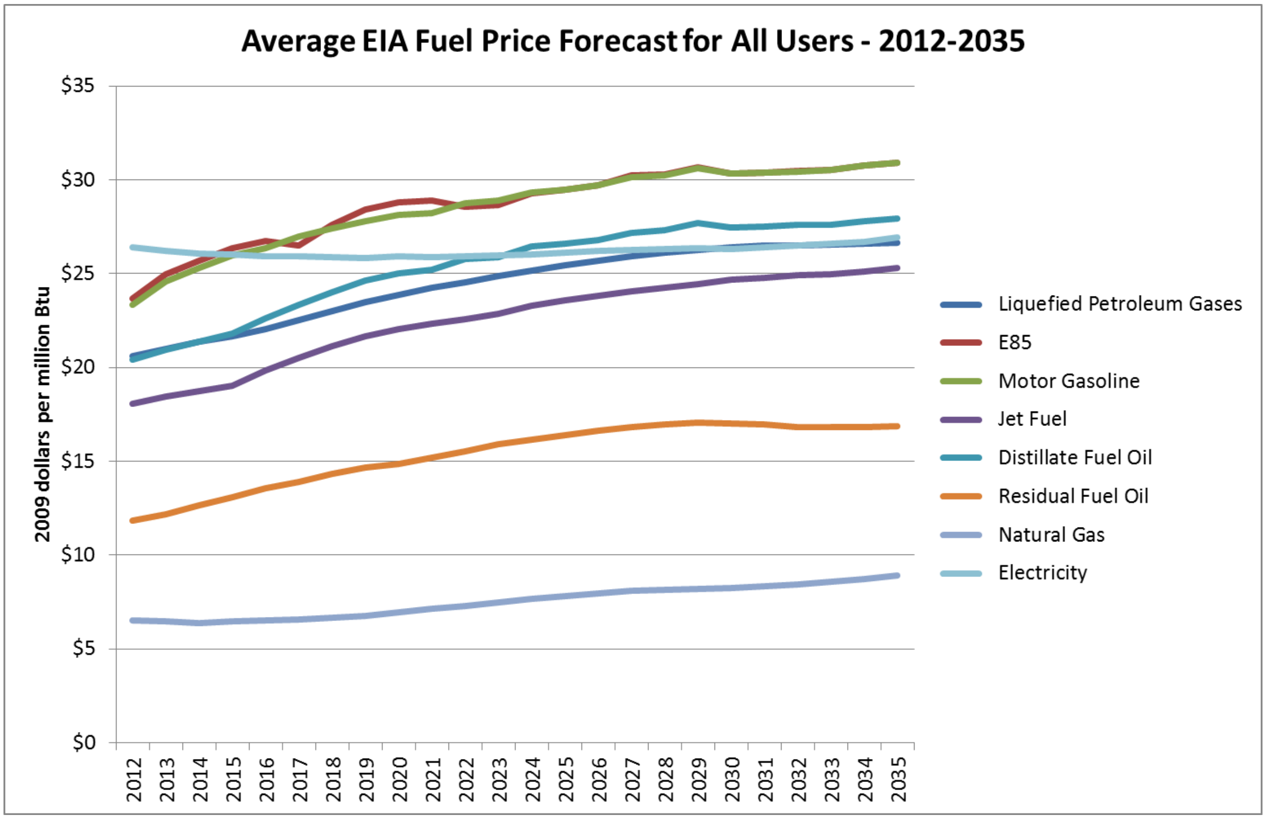


Figure 4: Real fuel price forecast by fuel type

Electricity Trends, Regional Market, and Contracts Renewal

Utility-specific retail electricity prices vary depending on the electric utility and on the sector (residential vs. commercial). Not only are demand and supply for electricity connected (Figure 5)[24] but the market is also a regional market that is directly affected by supply and demand, trends, and peak demand events in the rest of New England.

[24] 2011 Vermont Comprehensive Energy Plan, Data source: EIA, DPS, U.S. Bureau of Labor Statistics

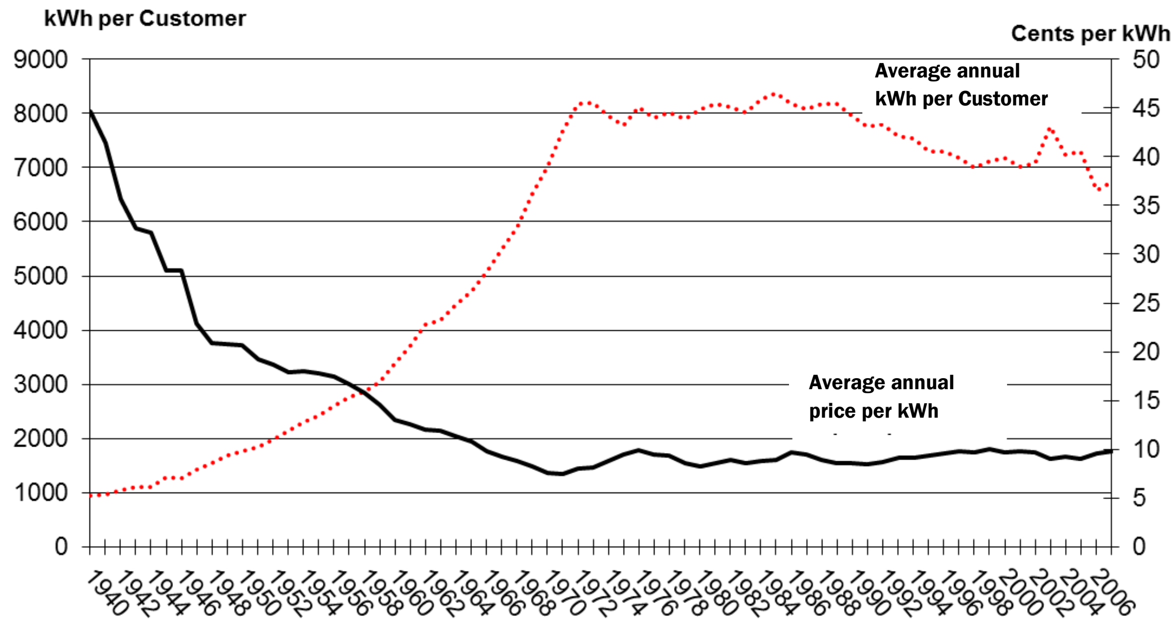


Figure 5: Electric demand per customer and real price per kWh in Vermont 1940-2007 (1991$)

Vermont's electric utilities are regulated monopolies that operate under a "certificate of public good" granted by the Vermont Public Service Board. As regulated monopolies, their rates and policies are subject to review by the Vermont Department of Public Service and approval by the Public Service Board. Individual entities can communicate their concerns regarding electric rates by voicing their opinions to their utility during long-term contract discussions, or by expressing their concerns to the Public Service Board. Several players and forces affect electric rates in Vermont and therefore in Chittenden County (see Public Service Board website for more details):

o Vermont's power grid is operated by the Vermont Electric Power Company (VELCO), VELCO is a regulated utility, owned and controlled in various percentages by 14 of the state's utilities. VELCO operates Vermont's bulk transmission system and represents the utilities in power pool matters with the New England Independent System Operator (ISO New England).

o The New England Independent System Operator (ISO-NE) is designated by the Federal Energy Regulatory Commission as the Regional Transmission Organization that manages the New England region's bulk power generation and transmission system.

o To address the particular needs of Vermont's smaller publicly-owned utilities, the Vermont Public Power Supply (VPPSA) was created to pool resources and obtain economies of scale.

o Vermont has a number of independently-owned wholesale generators who account for 6 to 8 percent of total generation. While they provide reliable power, they offer the service at relatively high prices.

The diversity of players and complexity of the electric retail market requires well-organized groups to form if they aim to influence market prices; efforts are more likely to be successful at the state or regional level than at the county level, because the electric market is organized regionally, and because utility boundaries do not match county lines

Electricity is sold in a regionally competitive market. By being connected to the regional grid, utilities serving Chittenden County must often rely on the regional market for shorter-term contracts. Therefore, even though there is little significant gas-fired generation owned or directly contracted by Vermont utilities, ratepayers in Chittenden County have some exposure to the variability of natural gas prices. In addition, long-term contracts entered into by utilities serving Chittenden County are often based upon regional market prices. Energy efficiency and distributed generation has the potential to mitigate Chittenden County's susceptibility to regional market prices. This is discussed further in the next section of the report. For more details on this topic, the 2011 Avoided Energy Supply Costs study[25] provides a good resource for projections of marginal energy supply costs that will be avoided via improvements in energy efficiency throughout New England.

Many of the long term electricity supply contracts that Chittenden County (and other Vermont utilities) had established are expiring. Many utilities are transitioning to new long-term contracts with Hydro Quebec and others over the next few years, and are expected to end purchases from Vermont Yankee in 2012 (see Energy Supply section of the ECOS Energy report for more details).

Transportation

In Vermont, transportation costs are usually the second-largest expense of a household, after housing costs. Transportation costs us more than food, clothing, and health care.[26] The average annual per capita spending on gasoline in Chittenden County is estimated at $1,100-1,800 in 2009-2011 (Table 3). Gasoline cost can be between one sixth and one tenth of the total cost of owning and operating a motor vehicle. Annual residential spending on cars depends on the vehicle type. As expected, vehicles with lower mileage efficiency cost more, almost twice as much between a small sedan and an SUV.[27] Total cost to own and operate a motor vehicle being driven 15,000 miles annually range from approximately $6,500 to a little over $11,000.[28]

"*An owner of a compact vehicle with average fuel economy will buy more than 6,000 gallons of gasoline and spend $18,000 on this fuel over the vehicle's 15-year lifetime, assuming a gas price of $3.50 per gallon. (…) With a national average price for electricity of about 11 cents/kWh a typical midsize EV could save nearly $13,000.Most electric vehicles being offered by automakers today are small to midsize cars, a trend expected to continue over the next few years, so fuel-cost savings from EVs are compared with the average new compact gasoline vehicle, which has an EPA city/highway fuel economy rating of 27 mpg. Even compared with the cost of fueling a 50 mpg gasoline vehicle, an EV could save more than $4,500*" [29]

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[25] Synapse 2011 Avoided Energy Supply Costs study (AESC 2011)
[26] 2011 Vermont Comprehensive Energy Plan
[27] Ibid
[28] American Automobile Association: "Your Driving Costs," 2010
[29] http://www.ucsusa.org/assets/documents/clean_vehicles/electric-car-global-warming-emissions-report.pdf

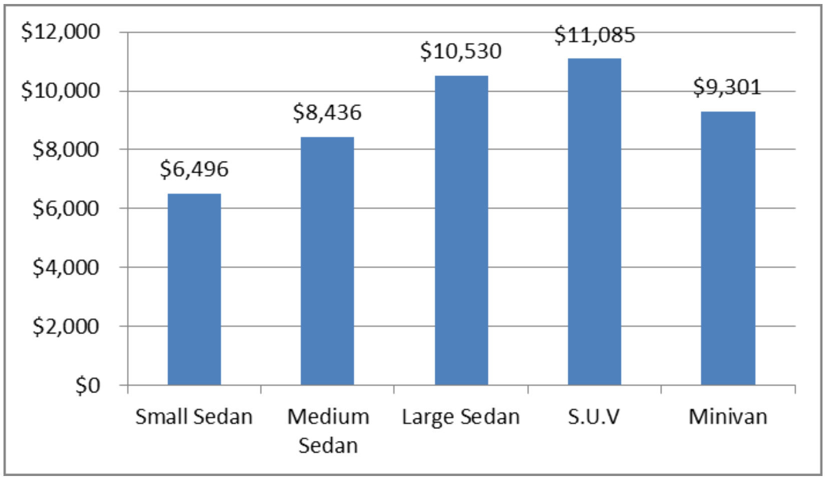


Figure 6: Annual Vehicle Ownership and Operating Costs in Vermont, 2010

Compared to the rest of the country, gasoline prices in Chittenden County are historically in the middle of the national range (Figure 7) and do not differ much from prices in other Vermont counties.[30]

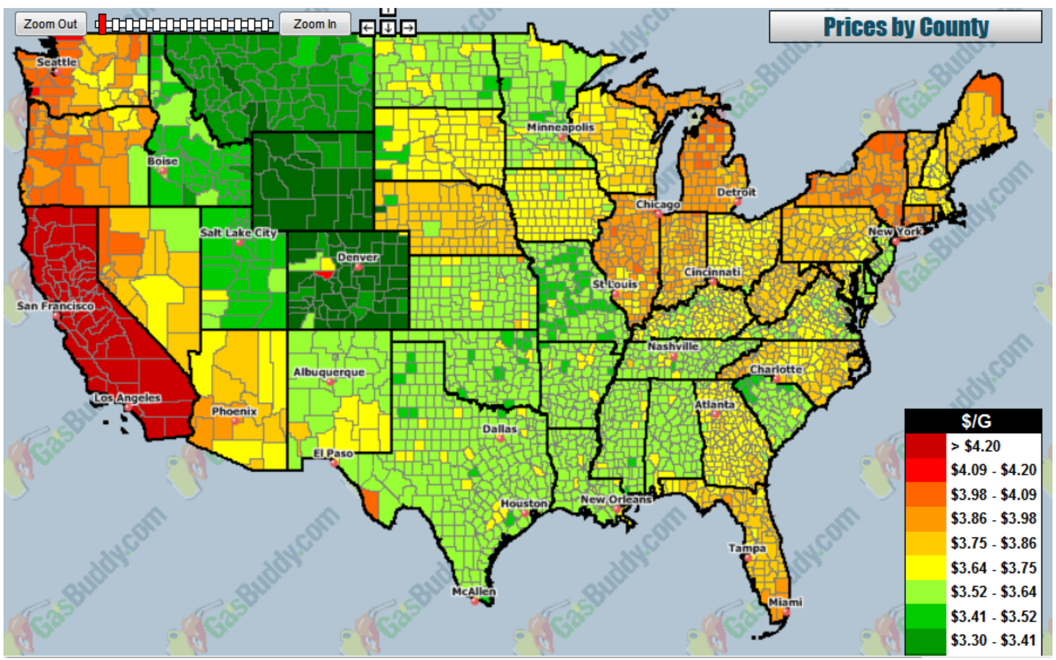
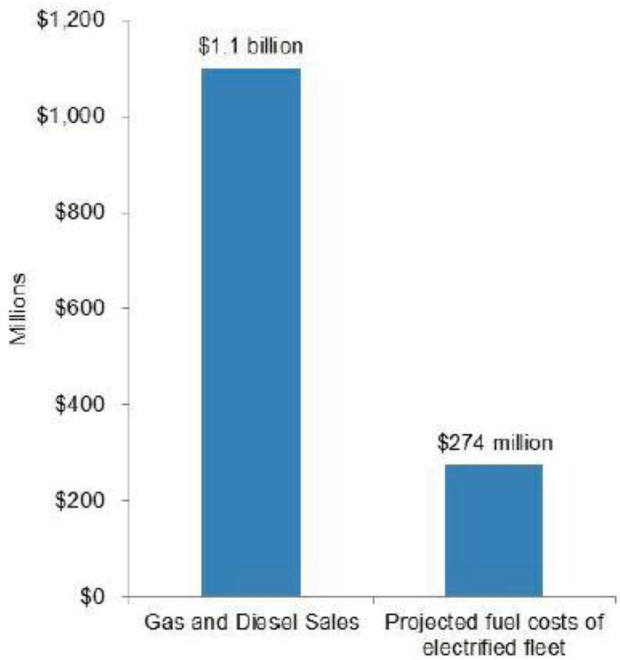


Figure 7: Gasoline prices nationwide

Driving a car on gasoline is expensive and is expected to become more costly in the future. Options other than single-occupancy vehicle trips exist and are generally more economical for Chittenden County's households. The total avoided cost from switching from driving a car to traveling by bicycle or walk can be computed and has been estimated at $26 million for Vermont urban areas, and $8 million

[30] www.gabuddy.com updated 3/7/2012

for Vermont rural areas.[31] Walking and biking have some additional economic benefits for the traveller and society, due to improved health from the physical activity and thus a decrease in preventable illness and disease. Providing options to single occupancy motorized transport requires a framework of policies, programs and infrastructure to enable their efficient use. These options, from active transportation modes (walking, biking, pushing) to more efficient use of motorized transport (car pool, ride sharing, car sharing and van pools) require a concerted effort to become reality. In addition increasing the efficiency of the vehicle fleet in Chittenden County could dramatically decrease the energy costs to residents. For instance if the entire Chittenden county vehicle fleet were electrified the total energy cost would decrease by nearly two thirds (Figure 8):[32]



**This estimate of Vermonters' vehicle miles traveled was derived from the Vermont National Household Travel Survey, described in Section 4.2 of this report.*

Figure 8: Cost of electric cars vs. gas and diesel sales

[31] Economic Impact of Walking and Biking in Vermont, Draft Report, RSG Inc. Transportation, January 2012

[32] based on extrapolating from statewide number from the Vermont Transportation Energy Report 2011

Table 8: Transportation System Unit Cost for Urban Travel (2009 $/mile traveled)[33]

Cost Category	Automobile				Bike				Walk			
	Total	*Consumer Fixed*	*Consumer Variable*	*Public*	*Total*	*Consumer Fixed*	*Consumer Variable*	*Public*	*Total*	*Consumer Fixed*	*Consumer Variable*	*Public*
Vehicle Ownership	$0.28	$0.28	-	-	$0.07	$0.07		-	$0.00	$0.00		-
Vehicle Operation	$0.18	-	$0.18	-	$0.03	-	$0.03	-	$0.05	-	$0.05	-
Travel Time	$0.10	-	$0.10	-	$0.39	-	$0.39	-	$1.29	-	$1.29	-
Internal Crash	$0.09	-	$0.09	-	$0.09	-	$0.09	-	$0.09	-	$0.09	-
External Crash	$0.06	-	-	$0.06	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Internal Health Ben.	$0.00	-	-	$0.00	($0.10)	-	($0.10)	-	($0.25)	-	($0.25)	-
External Health Ben.	$0.00	-	-	$0.00	($0.10)	-	-	($0.10)	($0.25)	-	-	($0.25)
Internal Parking	$0.08	$0.08	-	-	$0.01	$0.01	-	-	$0.00	$0.00	-	-
External Parking	$0.06	-	-	$0.06	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Congestion	$0.03	-	-	$0.03	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Road Facilities	$0.03	-	-	$0.03	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Land Value	$0.04	-	-	$0.04	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Traffic Services	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Transport Diversity	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Air Pollution	$0.05	-	-	$0.05	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Green House Gas	$0.02	-	-	$0.02	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Noise	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Resource Externalities	$0.04	-	-	$0.04	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Barrier Effect	$0.02	-	-	$0.02	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Land Use Impacts	$0.09	-	-	$0.09	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Water Pollution	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Waste	$0.00	-	-	$0.00	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Totals (Dollars per mile)	*$1.21*	$0.36	$0.36	$0.48	*$0.40*	$0.07	$0.41	($0.08)	*$0.95*	$0.00	$1.19	($0.24)

Table 9: Transportation System Unit Cost for Rural Travel (2009 $/mile traveled)[34]

Cost Category	Automobile				Bike				Walk			
	Total	*Consumer Fixed*	*Consumer Variable*	*Public*	*Total*	*Consumer Fixed*	*Consumer Variable*	*Public*	*Total*	*Consumer Fixed*	*Consumer Variable*	*Public*
Vehicle Ownership	$0.28	$0.28	-	-	$0.07	$0.07	-	-	$0.00	$0.00	-	-
Vehicle Operation	$0.15	-	$0.15	-	$0.03	-	$0.03	-	$0.05	-	$0.05	-
Travel Time	$0.06	-	$0.06	-	$0.39	-	$0.39	-	$1.29	-	$1.29	-
Internal Crash	$0.09	-	$0.09	-	$0.09	-	$0.09	-	$0.09	-	$0.09	-
External Crash	$0.06	-	-	$0.06	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Internal Health Ben.	$0.00	-	-	$0.00	($0.10)	-	($0.10)	-	($0.25)	-	($0.25)	-
External Health Ben.	$0.00	-	-	$0.00	($0.10)	-	-	($0.10)	($0.25)	-	-	($0.25)
Internal Parking	$0.04	$0.04	-	-	$0.00	$0.00	-	-	$0.00	$0.00	-	-
External Parking	$0.03	-	-	$0.03	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Congestion	$0.00	-	-	$0.00	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Road Facilities	$0.02	-	-	$0.02	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Land Value	$0.04	-	-	$0.04	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Traffic Services	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Transport Diversity	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Air Pollution	$0.00	-	-	$0.00	$0.00	-	-	$0.00	$0.00	-	-	$0.00
GHG	$0.02	-	-	$0.02	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Noise	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Resource Externalities	$0.04	-	-	$0.04	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Barrier Effect	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Land Use Impacts	$0.04	-	-	$0.04	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Water Pollution	$0.01	-	-	$0.01	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Waste	$0.00	-	-	$0.00	$0.00	-	-	$0.00	$0.00	-	-	$0.00
Totals (Dollars per mile)	*$0.90*	$0.32	$0.30	$0.28	*$0.38*	$0.07	$0.40	($0.09)	*$0.95*	$0.00	$1.19	($0.24)

33 Economic Impact of Walking and Biking in Vermont, Draft Report, RSG Inc. Transportation, January 2012

34 Ibid

Societal monetary benefits other than healthcare related benefits exist for transportation options other than the single occupancy vehicle trip. Walking and biking provide widely accessible options other than driving. Pedestrian and bicycling-related infrastructure adds to the local economy through building and maintaining infrastructure (Table 10), increased tourism from these infrastructures, as well as the addition of businesses specializing in bicycling gear supply and repair. The effect of walkability on the value of home sales was evaluated in a report, and in Vermont there may be an increase of home value from being within walking distance of amenities valued at $350 million statewide.[35]

Table 10: estimates of bicycle/pedestrian infrastructure and program costs in Vermont, 2009.

Description	**Total**
Vermont Agency of Transportation	
Bridge Shoulder Widening	$322,807
Bridge Sidewalks	$3,306,806
Roadway Shoulder Widening	$28,326
Roadway related bicycle and pedestrian features	$192,161
Bike/pedestrian Safety projects	$161,841
Paved shoulders	$313,834
Bike/pedestrian features in paving projects	$1,074,464
Enhancement Program	$1,011,170
Bicycle/Pedestrian Program	$369,287
Subtotal, Vermont Agency of Transportation	*$6,780,696*
Recreational Trail Grant Program	
Local Community Projects	$606,513
State Projects	$305,998
Subtotal, Recreational Trails Grant Program	*$912,511*
Annual Municipal Sidewalk/Bicycle Projects & Maintenance	$1,300,000
Private Sector Sidewalks with Housing Projects	$820,000
Grand total	**$9,813,206**

Sources: Vermont Agency of Transportation; Various non-profit recreational trail groups; Department of Public Works, various Vermont municipalities; and US Census Bureau.
Compiled and estimated by Resource Systems Group, Inc. and Economic & Policy Resources, Inc.

The Chittenden County Transportation Authority (CCTA) provides public transit services to many towns in the county: Burlington, Charlotte, Colchester, Essex, Essex junction, Hinesburg (starting April 2012), Milton, Richmond, Shelburne, South Burlington, Williston, and Winooski.[36] CCTA operates 55 buses, including 12 which can operate with biodiesel. [37] Between 2007 and 2011, CCTA used biodiesel to fuel some of its buses. But in fiscal year 2012, the price of ultra-low sulfur diesel, which CCTA uses for the majority of its buses, has gone up to $3.29 per gallon, to the point where CCTA had to suspend the use of biodiesel in its fleet. Biodiesel costs CCTA $0.11 cents per gallon more than ultra-low sulfur diesel. As a result of increasing transportation fuel prices, CCTA had to suspend the use of biodiesel to maintain a viable budget and avoid cutting back services.[38] The competitiveness of biofuels changes as the price of traditional fuel sources increases. While the use of biofuels may not always be possible at this time,

[35] Economic Impact of Walking and Biking in Vermont, Draft Report, RSG Inc. Transportation, January 2012
[36] http://www.cctaride.org/bus-information/system-map.html
[37] http://www.cctaride.org/about/faq.html
[38] http://vtdigger.org/2011/02/25/chittenden-county-transportation-authority-suspends-use-of-biodiesel-to-cut-costs/

especially with tight budgets, the price of fossil fuel may in the near future increase to a point where biofuels will be competitive on the market.

Like with other sectors (electricity, natural gas, other transportation infrastructure), CCTA plans for peak hours and the bus capacity and bus frequency are designed to accommodate peak hours demand. Therefore long term shifts in public transit peak hours and shifts in demand will in turn directly affect CCTA's transit infrastructure and operation costs. CCTA's operating budget is approximately $10 million.[39]

It has been estimated that statewide, transportation comprises approximately one sixth of the state's economy. Vermont Agency of transportation expenditure in 2010 was $459 million. Of that total, only 8% are used for non-single occupancy vehicle expenses:[40]

Road paving and maintenance	32%
Roadway	10%
Bridges (including maintenance)	14%
Town Programs	13%
Finance, Planning, DMV	8%
Public Transit	4%
Pedestrian and Bike	1%
Park and Ride	<1%
Rail	2%

Municipalities also spend a significant share of their budget on transportation expenditures (Figure 9), primarily for road infrastructure and maintenance. Spending on infrastructure and programs promoting transportation means with lower energy requirements (i.e. non-single occupancy vehicle) would promote a more sustainable use of energy in the transportation sector.

[39] http://www.cctaride.org/about/faq.html

[40] UVM Transportation Energy Report 2010 http://www.uvm.edu/~transctr/trc_reports/UVM-TRC-11-007.pdf

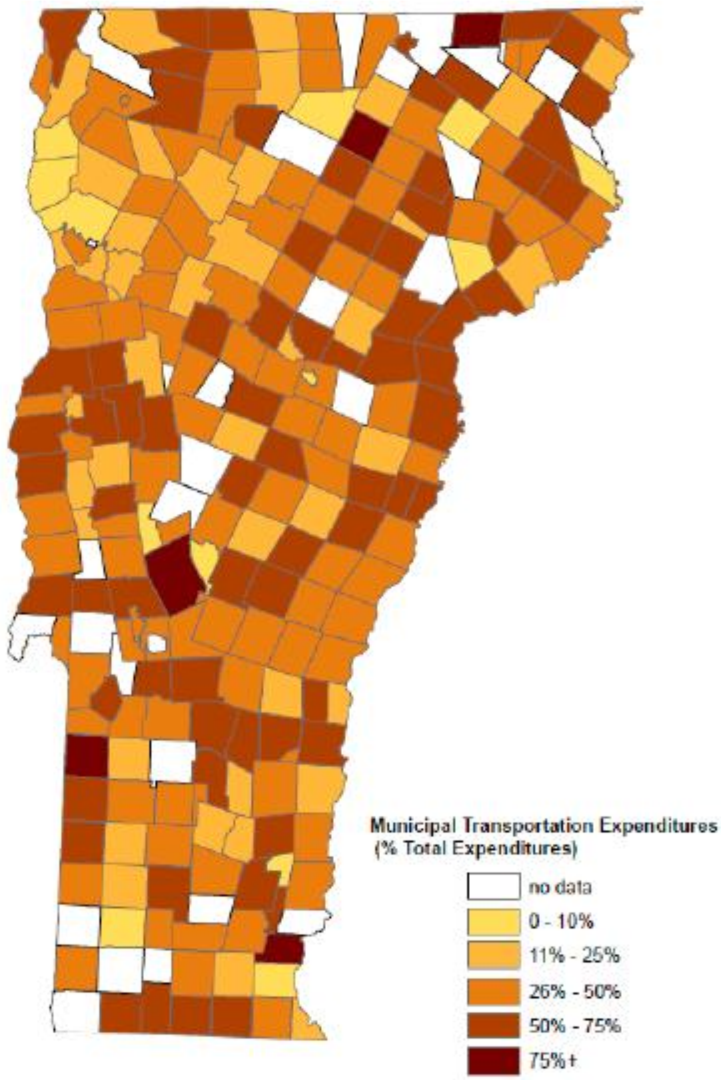


Figure 9: Municipal Transportation Expenditures (as % of total municipal expenditures)

Markets will transform

Efficiency

Energy efficiency is by definition the amount of useful output generated by a given amount of energy. Therefore, improving energy efficiency means that the same useful output (e.g. a television running, lights turning on, process steam used in industrial processes, miles traveled, etc.) is generated by using less energy, and therefore by spending less money on fuels. Energy efficiency does not imply that any sacrifice in the quality or quantity of the output is required, but rather that the same results can be obtained using less energy. By contrast, conservation measures often imply a sacrifice where the demand for the output is reduced (e.g. turning down the thermostat to reduce heat demand), leading to a reduction in energy needs.

Cost effectiveness and economic activity

Energy efficiency is a very cost effective way to provide energy capacity. The Efficiency Vermont Annual Report[41] states that in 2010, for every dollar spent on efficiency, 2.3 dollars of benefits resulted (a benefit-to-cost ratio of 2.3 to 1). Providing power generation through efficiency is much cheaper than providing it through electric power generation:

> *In 2010, Efficiency Vermont delivered energy efficiency at 4.0 cents per kWh. Taking into account participating customers' additional costs and savings, the levelized net resource cost of saved electric energy in 2010 was 1.9 cents per kWh. Comparable electric supply in 2010 cost 10.8 cents per kWh.*

The 2011 state energy plan provides a comprehensive discussion of the economic benefits of energy efficiency. We will only provide a brief overview of concepts that are applicable to Chittenden County and encourage readers interested in more details to consult the state energy plan.

From the customer point of view, many efficiency measures are cost effective with short pay-back periods, allowing residents and businesses to actually make money after a short period (compared to what they would have paid for energy had they not installed the efficiency measure).

In many cases efficiency is cheaper than supplying power (e.g. electricity production and distribution). Efficiency provides several economic benefits for the county's economy. These benefits include than the avoided cost of supplying and purchasing the energy itself, as well as the avoided cost of paying a premium for buying electricity on the regional market during peak demand events. Peak load is the electricity consumed during hours when the demand for electricity is very high; peak load determines the capacity that the transmission and distribution system needs to have in order to meet demand. Peak demand purchases on the regional market are generally more expensive. In addition, Vermont utilities pay a share of the Regional Network Service charge (RNS), which includes a share of the costs of reliability transmission projects happening regionally. Vermont's share is based on its contribution to the New England peak load. Efficiency contributes directly to reducing this peak load and therefore the share of Vermont's regional cost. Chittenden County residents therefore directly benefit from a reduction in peak demand.

Efficiency increases independence from regional market prices of electricity, avoided transmission and distribution upgrades, and distribution investments. Efficiency also provides local jobs and allows investment to remain in the local economy, rather than to leave the county towards foreign energy suppliers. Local efficiency jobs are created though efficiency programs and through market transformation (i.e. an efficiency measure becomes the norm or is required through federal standards or building code). Efficiency jobs include manufacturing, purchase, and installation of efficiency measures. Households and businesses that invest in efficiency will have more disposable income that can then be re-invested in the local economy and be more competitive.

[41] http://www.efficiencyvermont.com/docs/about_efficiency_vermont/annual_reports/2010_Annual_Report.pdf

Economic benefits of efficiency also include improved ecosystem and human health from decreased emission (particulate, NOx, Hg, etc.), greenhouse gas emission societal costs (global warming mitigation costs), as well as increased financial stability for low or fixed-income households. By consuming less fuel altogether, a household or business is shielded from fuel price volatility.

Efficiency measures are not only limited to electricity or thermal fuels, they are numerous in the transportation sector. Transportation efficiency measures may include vehicle fuel efficiency, driving style (Eco-driving), road surface, traffic signal synchronization, speed limit, and traffic flow improvements, etc. These transportation efficiency measures can be quantified and efficiency programs could be implemented to support the rapid transformation of the market. In addition, much like peak demand in the electric sector, peak hour traffic often drives transportation planning decisions. Reducing peak hour traffic may also reduce the need for additional costly transportation infrastructure. By providing options to single occupancy vehicle trips we could reduce the number of vehicles on the road. By simply doubling the number of people in the car we can double the efficiency of the vehicle and remove a vehicle from the road reducing congestion and possibly the need for additional car infrastructure (from parking, to signals, to new roadways). Putting the programs, policies and infrastructure in place to enable transportation efficiency measures to succeed will require new partnerships to be established. Total benefits from energy efficiency are calculated and summarized in the Efficiency Vermont, Burlington Electric, and Vermont Gas report. Thermal efficiency programs are less well developed in Chittenden County, due to fewer public dollars invested in these programs, but the potential is clearly there and investment in these programs would yield great additional financial benefits for Chittenden County and allow fuel dealers to transition to a new economy that does not rely on fossil fuels to such a great extent.

The economic benefits of efficiency are large and include the following:

> *Vermont's one-year energy efficiency budget leverages a net gain of 43 job-years (one full-time job for one year) for every million dollars of program spending, and a net increase over the life of the measures installed of nearly five dollars of Gross State Product for every public dollar spent. (..) For every $1 million of public electric efficiency investment by the EEUs, $4.6 million of present value benefit is returned to the state. (…) Every dollar spent on EEU delivered electric efficiency that increased gross domestic product by a multiple of more than five.*[42]

The benefits of energy efficiency of Chittenden County's economy are undisputable and warrant continued support of efficiency program and sustainable funding of thermal efficiency programs.

Dynamic Pricing and Improved Customer Choices for Rates.

As the electric transmission and distribution system evolves and includes more and more distributed generation systems (e.g. residential photovoltaic systems connected to the electric grid), as energy storage systems are installed to deal with intermittent electricity generation of distributed generation systems, and as the smart grid is put in place (allowing for voluntary demand response programs, among others), the implementation of a dynamic pricing with peak/off-peak rates and real time pricing

[42] 2011 Comprehensive State Energy Plan

becomes a real possibility. Controlling peak demand through dynamic pricing has some promises for cost savings, as load demand would not be reduced but rather shifted to off-peak times, when electricity is cheaper on the regional market. A similar strategy has been used in transportation: congestion pricing can be used in larger urban areas to reduce traffic and this could also be considered to address peak hour transportation congestion in Chittenden County.

Renewable Energy

Chittenden County specific data on cost per power produced (kW) and installation costs are not readily available for the county. Trends at the state or country level was used as a proxy to discuss where installation costs are headed and what this might mean for the future of renewable energy in Chittenden County. Many forms of renewable energy are currently more expensive to develop and deliver than existing fossil fuels, but markets are expected to transform and renewable energy installation costs are expected to decrease as market penetration increases, technology advances, and supply grows to meet demand.

The cost of photovoltaic (PV, or solar panel) systems is decreasing (Figure 10 and Figure 11[43]): a report found that nationwide, the cost of behind-the-meter[44] PV declined from $11.0/Watt capacity in 1998 to $6.2/Watt in 2010 (values adjusted for inflation and reported in 2010 $). Similar trends can be found in Vermont (Figure 11.).[45] The cost depends on system capacity with smaller systems being more expensive per unit of energy (Watt) produced (Figure 10). Behind-the-meter system size has been increasing over time: average system size (nationwide) went from around 6 kW in 1998 to 13 kW in 2010. Installation costs vary between states, with Vermont on the middle to lower end of the spectrum (Table 11). The net cost to the customer of a PV system also depends on tax breaks and incentive programs offered.[46]

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[43] Comprehensive Energy Plan, Date Source: Vermont Small Scale Renewable Energy Program, through June 2011

[44] Behind-the-meter: the generation interconnection is located behind a retail customer meter, for example a residential PV system (solar panels) connected to the electric grid.

[45] Comprehensive Energy Plan, Date Source: Vermont Small Scale Renewable Energy Program, through June 2011

[46] Tracking the Sun IV, An Historical Summary of the Installed Cost of Photovoltaics in the United States from 1998 to 2010, Galen Barbose, Naïm Darghouth, Ryan Wiser, Joachim Seel, September 2011, http://eetd.lbl.gov/ea/ems/reports/lbnl-5047e.pdf

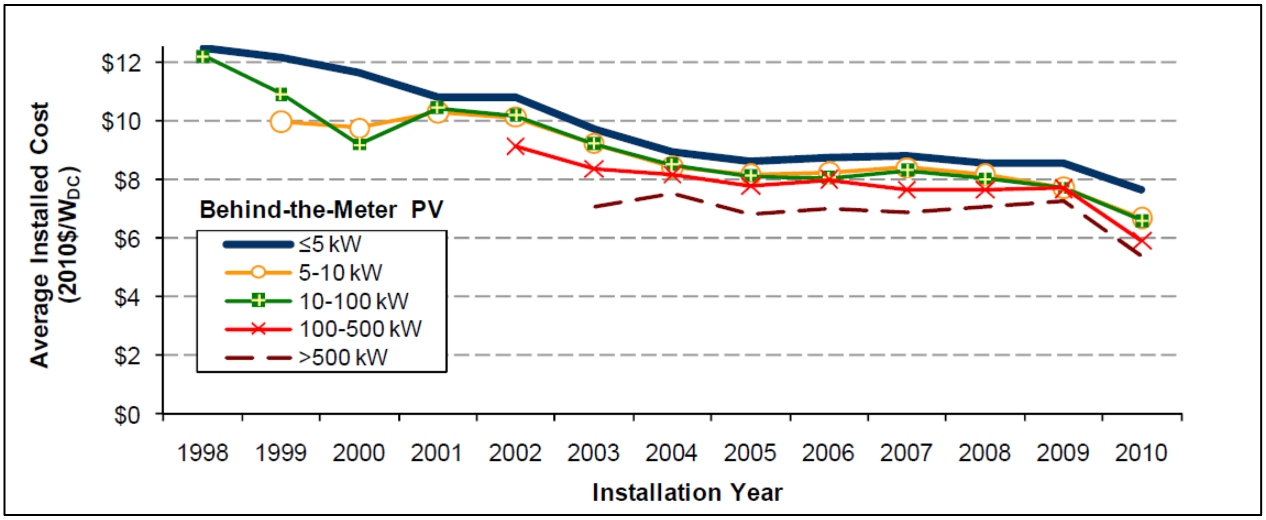


Figure 10: Average nationwide Installed cost of Behind-the-meter PV, by capacity

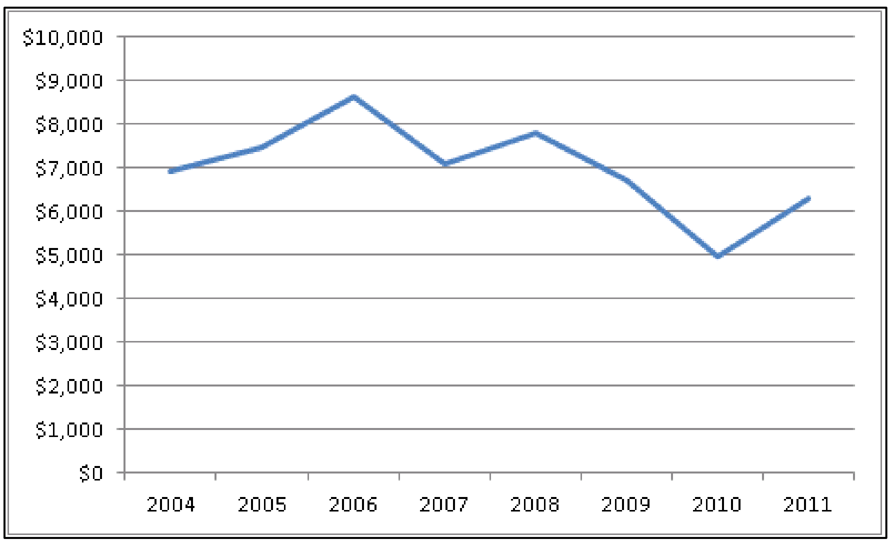


Figure 11: Cost ($ per kW) of Grid-Tied Photovoltaic Power in Vermont, 2004–2011

Table 11: Average installed cost ($/W) of behind-the-meter PV

State	All Reported Yrs. Capacity-Weighted Average Cost (all sizes)		2010 Systems									
			Capacity-Weighted Average Cost (all sizes)		Simple Average Cost							
					≤10 kW_{DC}		10 - 100 kW_{DC}		100 - 500 kW_{DC}		>500 kW_{DC}	
AR	$6.2	(n=46)	$6.2	(n=46)	$6.4	(n=39)	$6.1	(n=7)	*	(n=0)	*	(n=0)
AZ	$6.8	(n=8031)	$6.5	(n=4320)	$6.6	(n=3900)	$6.5	(n=403)	$6.8	(n=12)	$6.5	(n=5)
CA	$7.5	(n=77842)	$6.3	(n=18349)	$7.3	(n=16484)	$6.5	(n=1705)	$6.4	(n=104)	$5.3	(n=56)
CT	$8.1	(n=1598)	$7.3	(n=432)	$7.4	(n=339)	$7.0	(n=87)	$7.4	(n=6)	*	(n=0)
DC	$7.4	(n=129)	$6.8	(n=72)	$7.7	(n=69)	*	(n=3)	*	(n=0)	*	(n=0)
FL	$7.0	(n=1014)	$6.4	(n=281)	$7.2	(n=228)	$6.1	(n=47)	*	(n=3)	*	(n=3)
IL	$10.8	(n=517)	$10.0	(n=152)	$7.7	(n=125)	$8.6	(n=26)	*	(n=0)	*	(n=1)
MA	$7.0	(n=2746)	$5.9	(n=762)	$6.9	(n=520)	$7.0	(n=177)	$6.0	(n=58)	$5.2	(n=7)
MD	$6.8	(n=1278)	$6.0	(n=562)	$6.5	(n=493)	$5.6	(n=68)	*	(n=1)	*	(n=0)
MN	$7.4	(n=409)	$6.5	(n=187)	$8.0	(n=161)	$7.3	(n=25)	*	(n=0)	*	(n=1)
NH	$6.8	(n=367)	$6.0	(n=161)	$6.3	(n=158)	*	(n=3)	*	(n=0)	*	(n=0)
NJ	$6.8	(n=7683)	$5.7	(n=2939)	$7.1	(n=2117)	$6.8	(n=673)	$5.5	(n=120)	$4.8	(n=29)
NM	$6.5	(n=952)	$6.2	(n=720)	$7.2	(n=693)	$6.4	(n=26)	*	(n=0)	*	(n=1)
NV	$6.3	(n=884)	$5.7	(n=360)	$6.4	(n=231)	$5.8	(n=122)	$5.3	(n=7)	*	(n=0)
NY	$8.2	(n=2973)	$7.3	(n=972)	$7.4	(n=715)	$7.5	(n=256)	*	(n=1)	*	(n=0)
OH	$6.3	(n=185)	$6.0	(n=62)	$8.3	(n=6)	$6.9	(n=45)	$6.6	(n=10)	*	(n=1)
OR	$7.4	(n=2539)	$6.7	(n=1170)	$6.7	(n=1073)	$7.2	(n=79)	$6.6	(n=18)	*	(n=0)
PA	$6.2	(n=3265)	$6.0	(n=2729)	$6.8	(n=1938)	$6.3	(n=717)	$5.6	(n=70)	*	(n=4)
TX	$6.5	(n=1714)	$5.9	(n=587)	$6.4	(n=484)	$6.0	(n=97)	$5.2	(n=6)	*	(n=0)
UT	$9.4	(n=129)	$8.5	(n=34)	$8.4	(n=29)	$8.1	(n=5)	*	(n=0)	*	(n=0)
VT	$7.5	(n=533)	$6.2	(n=167)	$6.6	(n=153)	$5.7	(n=14)	*	(n=0)	*	(n=0)
WI	$8.2	(n=1039)	$7.2	(n=332)	$7.9	(n=238)	$7.3	(n=93)	*	(n=1)	*	(n=0)

Notes: The table includes only the 22 states for which data were provided by PV incentive program administrators (i.e., excludes states for which the Section 1603 Grant Program database was the only data source). Cost data for individual size bins in a given state are omitted (*) if fewer than five data points are available.

Approximate price ranges for solar hot water systems (closed loop, household sized) are provided in Table 12. [47] Solar hot water systems are now cost-effective for many families to install, with relatively short time periods for return on investment, if upfront capital or good financing options are available.

Table 12: Cost of solar hot water systems in Vermont

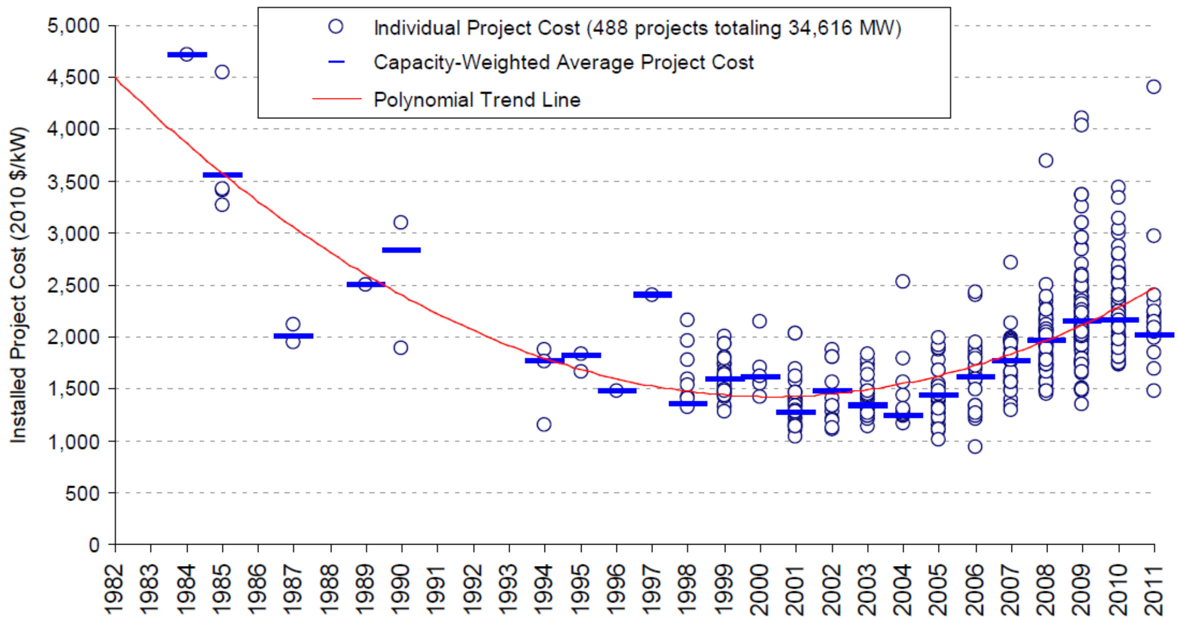
Household Members	Collector Area (square feet)	Storage Tank Size (gallons)	Typical Installed Cost
2	64	80	$8,200 - $11,00
3	96	120	$8,300 - $12,900
4	128	150	$10,800 - $18,000

The cost of wind systems depends on a number of factors ranging from the price of components, to permitting requirements. Unlike PV systems that show a consistent decline in system and installation costs, wind systems cost trends[48] are complex. Installed costs decline between 1980s to the early 2000s, and have recently increased (Figure 12). In 2010, the capacity-weighted average installed cost was $2,155/kW, 65% higher than the average cost of projects installed 2001-2004. There is some indication

[47] http://www.rerc-vt.org/shw_investing.htm

[48] Including turbine purchase and installation, balance of plant, and any substation and/or interconnection expenses.

that projects costs have now reached a plateau or reversal of trend since 2009, which is consistent with the declining price of turbines, which is expected to continue to decline. Project cost per unit of energy produced (kW) varies with system size, with economies of scale from projects less than 5 MW to projects 20 MW and above. Project costs vary by state with Texas having the lowest costs and California and New England the highest costs.[49]



Note: 2011 data represent preliminary cost estimates for a sample of 17 projects totaling 1.1 GW that have either already been or will be built in 2011, and for which reliable cost estimates were available.
Source: Berkeley Lab (some data points suppressed to protect confidentiality)

Figure 12: Installed wind project costs (2010 $/kW)

The potential for micro-hydro in Chittenden County is very small and system costs will not be discussed in this report.

Wood biomass (green wood) is currently the cheapest heating fuel in Vermont (14.39 $/MMBTU,

Table 7). As demand for wood biomass fluctuates due to an increase demand for woody biomass for heat, steam, and electricity generation, wood may become more expensive. Pellet technologies (wood pellets, herbaceous pellets) make additional heating fuel available at competitive prices. Many biomass options exist, such as biofuels (ethanol, biodiesel), digesters for methane production (wastewater, food system waste, landfill waste, farm methane), etc. As other biomass fuels become more readily available at competitive prices (Figure 13),[50] biomass options should become more attractive and more widely

[49] 2010 Wind Technologies Market Report, US Department of Energy, Ryan Wiser and Mark Bolinger, LBNL, June 2011, http://eetd.lbl.gov/ea/emp/reports/lbnl-4820e.pdf
[50] DOE Biomass Multi-Year Program Plan, 2011

implemented. Options exist to reduce emissions and air quality issues with biomass combustion; these air pollution mitigation measures may add to the installation costs of biomass systems.

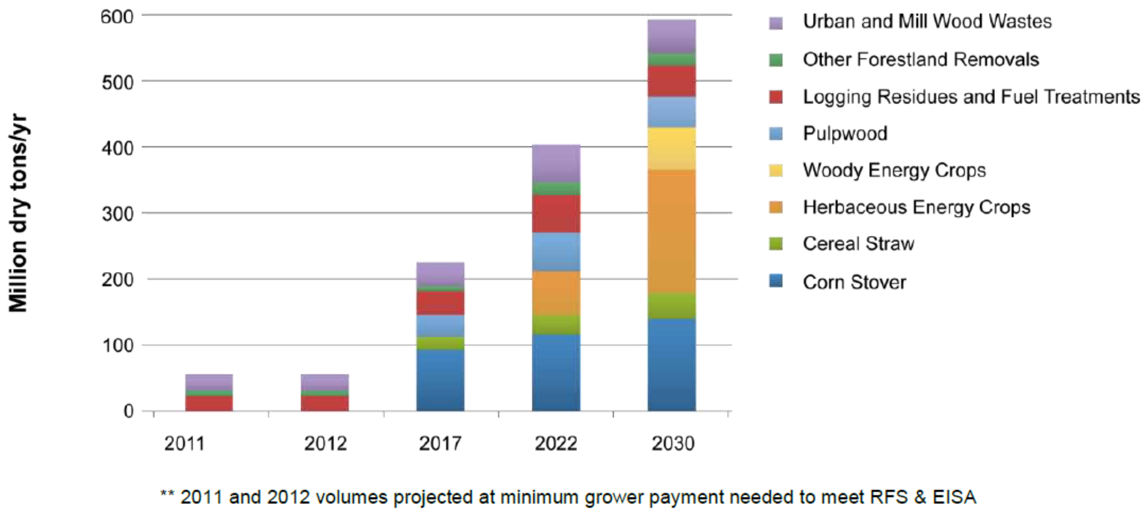


Figure 13: Projected Feedstock Availability at Specific Minimum Grower Payments

Direct investment and incentives toward projects that maximize biomass fuel-use efficiency, and displace fossil fuels should be designed to support the development of the biomass market. Liquid biofuels are an opportunity for agriculture in Vermont, especially on-farm biodiesel. Biodiesel production and on-farm consumption generate many benefits to the farm, including fuel and feed cost reductions, while helping society to reduce its reliance on traditional fossil fuels.

Rule 4.100 allowed renewable generators to access stably priced long-term contracts. Twenty hydro projects and one large wood project entered into contracts under this rule. This rule also set up a central purchasing authority (Vermont Electric Power Producers Inc.) to purchase the output from Qualifying Facilities and allocate the costs and energy among the Vermont utilities. Many of these projects have contracts ending soon

Alternative fuels and Transportation

Economics of biofuels and natural gas

As alternatives to oil are explored and biofuels become widely available, the diversity of fuels, their price volatility, and their demand and supply will all affect the price of transportation fuels. As of 2010, the average cost to produce biodiesel from oilseed crops grown on Vermont farms was $2.81 per gallon.[51] Therefore, farmers can currently save about $1 per gallon on average by producing their own biofuel. As of the summer of 2011, natural gas costs are $2.39 per gasoline gallon equivalent and $2.58 per diesel gallon equivalent. This represents a savings of almost 65% over conventional fuels.[52]

[51] Include all fixed and recurring costs.
[52] 2011 Comprehensive State Energy Plan.

Economics of using renewables to power electric vehicles

In addition to vehicles powered with liquid fuels or natural gas, electric vehicles (EV) may become a widespread option in the near future. In that case, the prevalence of electric cars and the time of day when vehicles are charged will have an impact on the retail price of electricity. Peak electricity (i.e. electricity consumed during peak hours, when demand for electricity is high) is much more expensive to electric utilities than off-peak electricity, because there is a higher demand on the regional market. With plug-in vehicles becoming more widely available, there may be an increase in peak demand. Utilities would then have the option to directly pass the additional cost of on-peak vehicle charging to the customer by charging variable peak pricing (i.e. electricity sold at a premium during certain peak hours), or they would have the option to absorb the cost increase from the additional on-peak demand and distribute that additional cost in their standard, fixed rates.

One of the greatest challenges for the market development of EV is currently their higher up-front cost. Improving on financing programs targeted at customers interested in purchasing an EV will have a positive effect on market development, by allowing customers to overcome the upfront cost barrier. At the time of this writing, a $7,500 tax credit is available for the purchase of electric vehicles, to help overcome this up-front cost barrier.

The high up-front incremental cost of electric vehicles could be balanced with using renewable energy to power an electric car, but this may only be true if a large proportion of our electricity originates from renewable sources. Examples of solar charging stations already exist: CVPS is using solar power for their electric vehicle charging station in Rutland; the Burlington International Airport will be using solar array to power EV charging stations located in the parking garage. In any case, powering electric cars with renewable energy may result in a significant increase of the cost effectiveness of electric vehicles (including capital cost and operation costs). This will be especially true if gasoline prices continue to increase. Therefore, renewable energy is expected to offer a price advantage over gasoline when used for transportation in the electric vehicle future. In addition, the opportunity for vehicle to grid interoperability and the use of EV batteries as storage for renewable resources is promising. In any case, studies have shown that electric vehicles are overall cheaper in the long term even when not charged with on-site renewable energy systems. Even if EVs are not charged with renewable energy, the rate of adoption of electric vehicles (directly related to the percentage of new vehicles purchased being electric vehicles) is not expected to be high enough to place a great burden on the electric grid in the short to medium term. Therefore, the peak demand issue is not expected to be an immediate concern and will probably evolve over the years and be accounted for during well-established transmission and distribution planning processes.

Electric rate payers currently contribute a portion of their electric bill (systems benefit charge) towards an efficiency fund that supports a statewide efficiency utility. Widespread adoption of plug-in EV may lead to an increase in efficiency funds collected, due to an increase in electricity use from charging vehicles. This increased funding could potentially be used to fund statewide transportation efficiency programs.

Policy, Investments, and Financing

Policies relating to the monetary aspects of energy are very similar to the overarching policies presented in the main section of the ECOS Energy report (see ECOS Energy report for details).

Recent developments in financing warrant and additional emphasis on two financing mechanisms:

A new, innovative financing approach is now are available to Chittenden County ratepayers looking to reduce their energy load: Property Assessed Clean Energy (PACE) program is a method of financing energy improvements[53] to residences with payments made through a special assessment payment along with the property tax payment. In order to become a PACE district in Vermont, a municipality must hold a public vote to create a district. The creation of the district gives eligible residential homeowners in the municipality access to financing for energy improvements to their homes. The amount of money that can be financed through PACE is 15% of the assessed value of the property or $30,000, whichever is less. The term of the assessment is for a maximum of 20 years or average measure life of the improvements, whichever is less. This program is offered, through Efficiency Vermont, to Towns that have designated themselves as PACE districts. Through March 2012, Burlington and Richmond are the only Towns in Chittenden County that have designated themselves as PACE districts.

In 2005, the Vermont General Assembly established the Vermont Clean Energy Development Fund through Act 74 (10 V.S.A. § 6523). The goal of the Fund is to increase the development and deployment of cost-effective and environmentally sustainable electric power resources – primarily with respect to renewable energy resources, and the use of combined heat and power technologies - in Vermont. The fund has historically supported incentives, grants, financing, and tax credits for small-scale renewable installations.[54] The Clean Energy Development Fund Board is developing a strategic plan including financing recommendations for the Fund going forward, as its current source of funding expires in 2012. As of March 2012, an agreement was being developed between the Department of Public Service, Green Mountain Power (GMP), and Central Vermont Public Service (CVPS) following the merger of the two utilities. This agreement could result in up to $21 million being made available through an efficiency and clean energy fund as a result of a windfall requirement on CVPS to return money to ratepayers.

Conclusions

Energy costs can represent a large proportion of a household or business' budget. Energy prices affect all segments of the economy, but they are largely out of the control of residents and small-businesses of Chittenden County, due to the market expanding far beyond the County's boundaries. Chittenden county resident and businesses can currently best control their energy costs by adjusting their consumption, either through efficiency (e.g. choosing more energy efficient devices, better insulating buildings) or through conservation measures (e.g. closing the blinds rather than turning on the air conditioning, biking instead of driving). Energy costs can also be controlled by choosing fuels that are cheaper. This option is more risky because the price of fuels fluctuates and the price of many energy fuels (especially petroleum-based fuels) is expected to increase. The source of the energy that we consume will also affect the price. In some cases, more sustainable options (such as some renewable

[53] A list of eligible measure is available on:
http://www.efficiencyvermont.com/docs/about_efficiency_vermont/initiatives/PACE_eligible_measures.pdf
[54] http://publicservice.vermont.gov/energy/ee_cleanenergyfund.html

energy) may currently be more costly per unit of energy than fossil fuel-based energy but over the long term utility electricity or fossil fuel price increases will likely outpace the fixed cost of renewables. Even the fixed cost of renewable systems is expected to drop as sustainable energy sources become more prevalent and gain from economies of scale. Advocacy work and demands to key players regarding fuel prices may also be an effective longer term tool. Keeping residents and businesses of Chittenden County well-aware of the cost of energy and well-informed of options available for controlling their energy costs (efficiency, conservation, fuel switch, or advocacy) is essential. The County' planning commission can assist its residents and businesses by providing details on programs, financing options, or direct assistance(especially for lower-income residents) available to support them in their endeavors. In addition, the planning commission can encourage adoption of zoning and transportation plans that would reduce energy use in new development of buildings and vehicle travel.

Appendix A

BTU Fuel Conversion

Type of Energy	BTU/ unit
Fuel Oil, gallon	138,200
Kerosene,gallon	136,600
Propane, gallon	91,600
Natural Gas, therm	100,000
Electricity, kWh	3,412
Wood, cord (green)	22,000,000
Pellets (ton)	16,400,000