Vermont Law School
Greenhouse Gas Inventory

April 2014

Institute for Energy and the Environment
VERMONT LAW SCHOOL

American College & University Presidents Climate Commitment

Vermont Law School Campus Map

1. Kirsch House (now home of Solar Charging Station)
2. Jacobs House
3. Waterman Hall
4. Oakes Hall
5. Debevoise Hall
6. Chase Community Center
7. Cornell Library
8. Abbott House
9. Dearing House
10. Anderson House
11. Curtis House
12. Law Review
13. Rogers House
14. Davis House
15. Fay House
16. Eaton House
17. Eaton House Barn
18. Pierce House
19. Old School House
20. South Royalton Town Green
21. Center for Legal Services

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Executive Summary

This document represents the first comprehensive effort to quantify Vermont Law School's (VLS) Greenhouse Gas (GHG) emissions. In summer 2012, Dean Marc Mihaly tasked the Institute for Energy and the Environment (IEE) with conducting a GHG inventory and developing a Campus Sustainability Plan for VLS to fulfill the requirements of the American College & University Presidents' Climate Commitment (ACUPCC). The Greenhouse Gas Inventory is meant to be a tool that both baselines our current GHG emissions to assess the impacts of future projects and acts as a diagnostic tool to illustrate where we have the greatest opportunity for reducing our carbon footprint.

The results of this assessment show that the total emissions from VLS for the 2011-12 academic year are **2824.5** Megatons Carbon Dioxide Equivalent (MT CO2e). The greatest portion of VLS's carbon footprint came from student, faculty and staff commuting (45% of total GHG emissions), followed by institutionally sponsored air travel (26%), and Heating (16%). Overall emissions per capita were 3.55 MT CO2e per person.

Methodology

Collection of data for VLS's first official GHG inventory began in September 2012. To compile data for the GHG inventory, the IEE contacted the Buildings and Grounds department (B&G), Human Resources, and the Business Office. One source of scope 3 emissions, commuting data was derived from surveys conducted to students, faculty, and staff as described below. Because the IEE was largely faced with a general lack of data before 2010, the IEE focused its GHG analysis on the last two years (academic year 2010-11 and 2011-12.) Much of the data for scope 3 emissions had to be derived simultaneously with the process of conducting the inventory, and therefore data was only available for the past year. Although one or two years of data is generally not long enough to show trends in GHG emissions, these two years provide a meaningful average for heating related emissions because of the different heating requirements for the cold winter in 2010-11 and the warm winter in 2011-12.

Emissions data was derived from the Clean Air Cool Planet Carbon (CA-CP) Calculator, which is recommended by the ACUPCC, and consistent with the GHG Protocol established by the World Business Council for Sustainable Development and the World Resources Institute, an established standard in the field. Using the CA-CP Calculator, activity data (e.g., kilowatt hours of electricity, number of commuters, miles of air travel) are multiplied by an emissions factor (e.g., kg CO_2/kWh, kg CH_4/kWh) to yield emissions for each activity by specific type of greenhouse gas. The Calculator converts all measurable greenhouse gas emissions (carbon dioxide, methane, hydro fluorocarbons and others) into their carbon dioxide equivalent (CO_2e), expressed in metric tons (MT).

Emissions sources have been classified by "Scopes" which are defined in the ACUPCC Implementation Guide as follows:

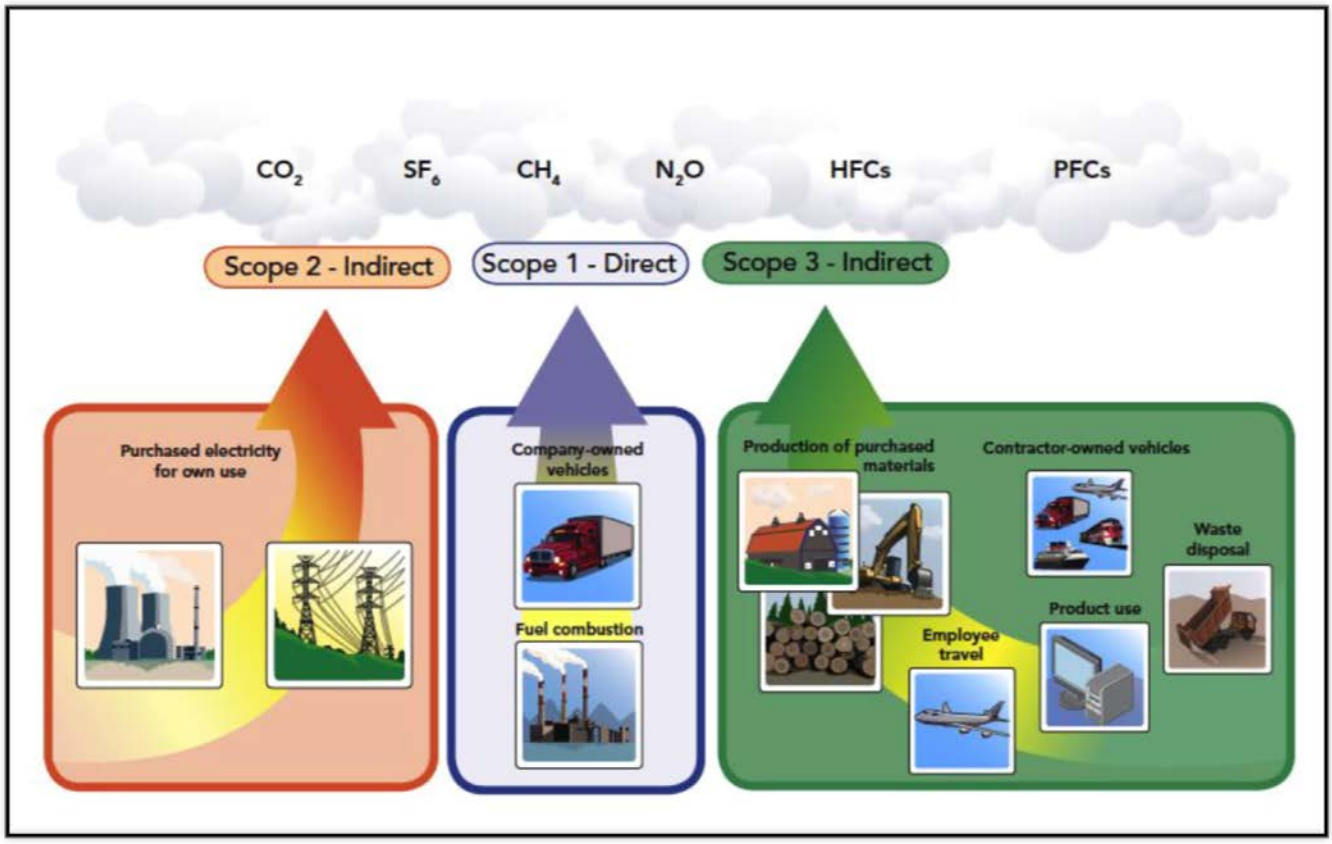
> Scope 1 emissions are those that are physically produced on campus (e.g. on-campus power production, campus vehicle fleets, refrigerant leaks). These sources are "owned or directly controlled" by the institution.

Scope 2 emissions are mostly associated with purchased utilities required for campus operation. They are indirect emissions resulting from activities that take place within the organizational boundaries of the institution, but that occur at sources owned or controlled by another entity.

Scope 3 includes emissions from sources that are not owned or controlled by the campus, but that are central to campus operations or activities (e.g. non-fleet transportation, employee/student commuting, air travel paid for by the institution).

The ACUPCC requires signatories to account for and report on Scope 1 and 2 emissions. In addition, two areas of Scope 3 emissions are required to be reported: air travel paid for by or through the institution staff to the extent that data is available and regular daily commuting to and from campus by students, faculty, and staff. However, signatories are strongly encouraged, to the extent practical, to investigate and report on additional Scope 3 emissions from sources that can be meaningfully influenced by our institution.

Vermont Law School's Scope 1 emissions include heating buildings and exhaust from B&G's on-campus vehicle fleet. Scope 2 emissions only include purchased electricity. The reported Scope 3 emissions include student, faculty and staff commuting; school sponsored air and ground travel, school sponsored ground travel, solid waste, paper, wastewater, and electricity transmission & distribution losses.



Scope 1, 2, 3 Emissions sources

Population, Budget, Physical Size data

At the beginning of the 2012-13 academic year, VLS enrolled 711 full time students and 24 part time students.[1] We currently have 63 faculty members and 103 staff members.[2] These numbers are similar for 2011 and 2010 where there were on average 682 full time students, 29 part time students, 69 faculty members and 106 staff members.

VLS is a non-profit institution and currently operates on an annual budget of $32.1 million.[3] The annual operating budget of Vermont Law School has been steadily rising annually from $23.7 million in 2008, $25.5 million in 2009, and $28.5 million in 2010.

Vermont Law School's heating and electricity budget was most recently $262,000 in 2011. It has been steadily rising since 2007 when heating and electric cost $245,000 until it peaked in the long cold winter of 2010-11 with a cost of $305,000. In addition to these figures Vermont Law School spends $15,000 annually on water[4], and $10,000 annually on sewer costs[5]. Surprisingly, a large budget expenditure of $53,000 is spent annually on computer paper. Buildings and grounds fuel use costs $4,442 annually. If you total these numbers, VLS's utility bills amount to $491,000 per year.

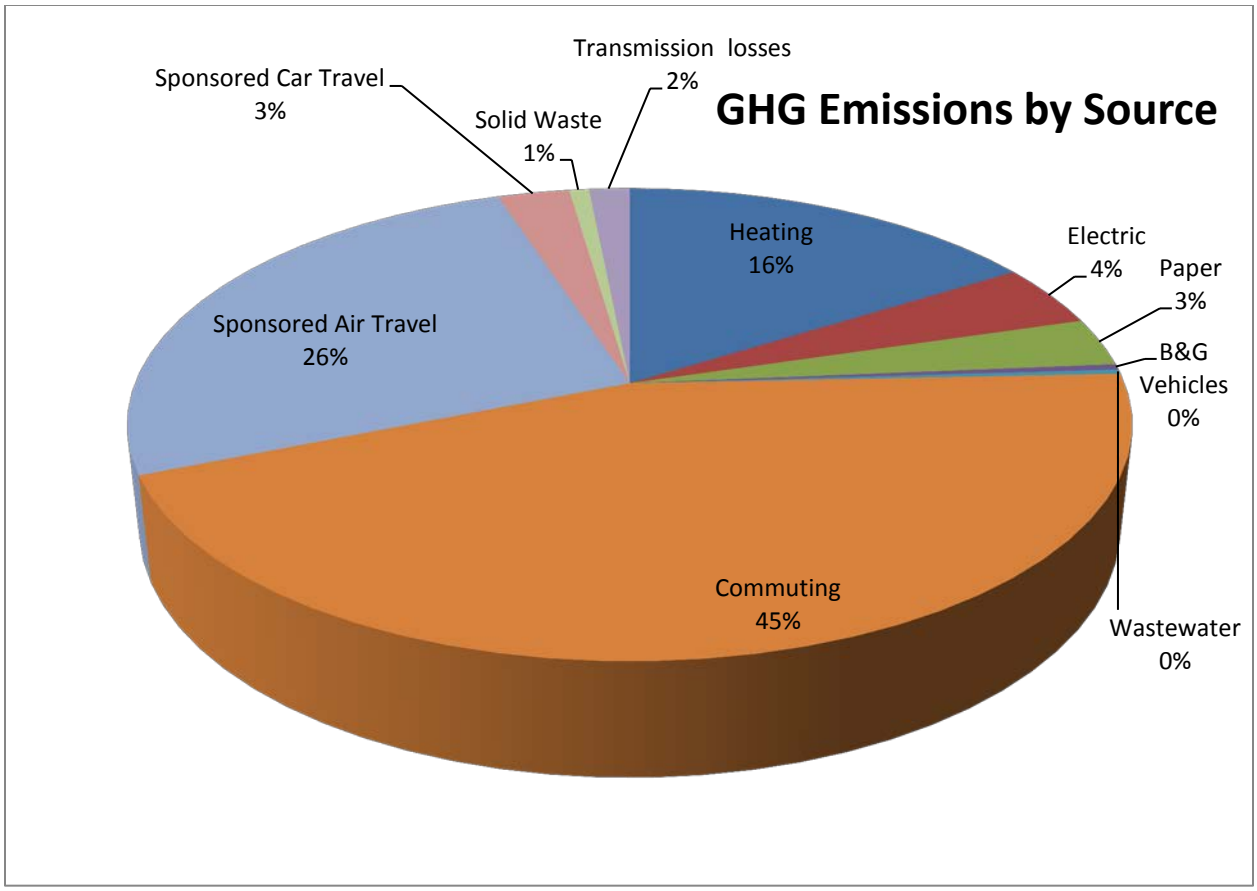
The twenty-one buildings on campus cumulatively have a total square footage of 166,000 sq. ft. Many of the buildings were previously residences that were purchased by the law school and converted into office space. One such building, Debevoise Hall, had a comprehensive LEED silver certified retrofit. Several buildings have been constructed by the law school including Oakes Hall, the Center for Legal Services, and the new Fitness Center.

[1] Student Enrollment data derived from annual Integrated Postsecondary Education Data System (IPEDS) reports
[2] Faculty and Staff data derived from Human Resources
[3] Total budget data derived from VLS's IRS Form 990 on Guidestar.org
[4] 2010 numbers derived from Buildings and Grounds
[5] 2010 numbers derived from Buildings and Grounds

Total Emission Summary

	2010-11 MT CO_2e	**2011-12 MT CO_2e**
Scope 1 Emissions Sources		
Stationary sources (heating)	566	375
Campus Fuel Fleet	N/A	11
Scope 2 Emissions Source		
Purchased Electricity	121	128
Scope 3 Emission Sources		
Commuting	N/A	1302
School Sponsored Air Travel	N/A	763
School Sponsored Car Travel	N/A	80
Solid Waste	N/A	22
Paper	96	96
Wastewater	0.3	0.5
Electricity transmission & distribution losses	44	47
TOTAL	**827.3**[6]	**2824.5**

[6] Since scope 3 emissions sources, are not available for all years comparing total emissions trends is not meaningful.



Scope 1 Emissions

On Campus Fuel Use

Data for fuel usage is derived from invoices for fuel purchased, therefore we assume the data to be high quality and reliable. Comprising 16% of our total emissions, VLS's 3rd largest emission source is burning number 2 heating oil, propane and diesel to heat buildings on campus. In 2010-11, VLS burned 54,061 gallons of heating oil, 2,802 gallons of propane, and 560 gallons of dyed diesel with total emissions from heating of **565.8** MT CO_2e. In 2011-12, VLS burned 33,700 gallons of heating oil, 4,781 gallons of propane and 98 gallons of dyed diesel with resulting total emissions of 375 metric tons. The steep drop in fuel use in 2011-12 was likely caused by a warm winter that year relative to the cold winter in 2010-11.

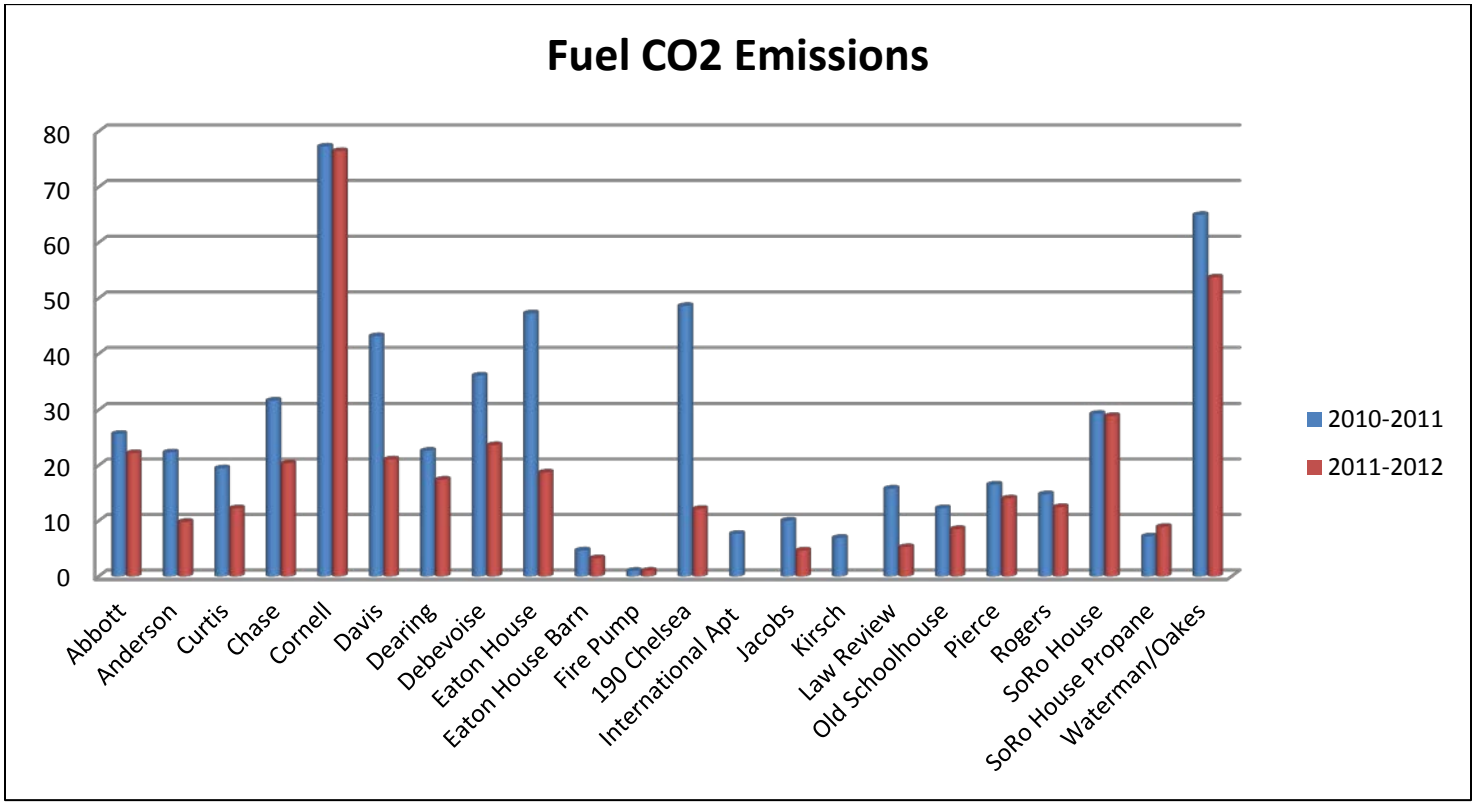
Buildings with the largest heating bill in order are the Cornell library, followed by Waterman/Oakes, Eaton House, Davis House, South Royalton House[7], and Abbott house. While many buildings used 25% less fuel or more between the cold winter of 2010-2011 and the warm winter of 2011-12, surprisingly this was not the case with all buildings. Cornell, Abbott, South Royalton House and Waterman/Oakes did not experience the 25% reduction in fuel use.

[7] The South Royalton House is leased by the Law School to prepare food for the VLS cafe

In January 2012, VLS performed energy audits on four campus buildings (Eaton House, Davis House, Law Review, and Anderson House). These buildings were selected because they had the highest energy intensity, (measured in BTU/sq. ft.) meaning that they required the most amount of energy to heat the building proportionate to the size of the building. The results of the energy audits indicated that these buildings were high energy users primarily because of poor insulation and a lack of air sealing.

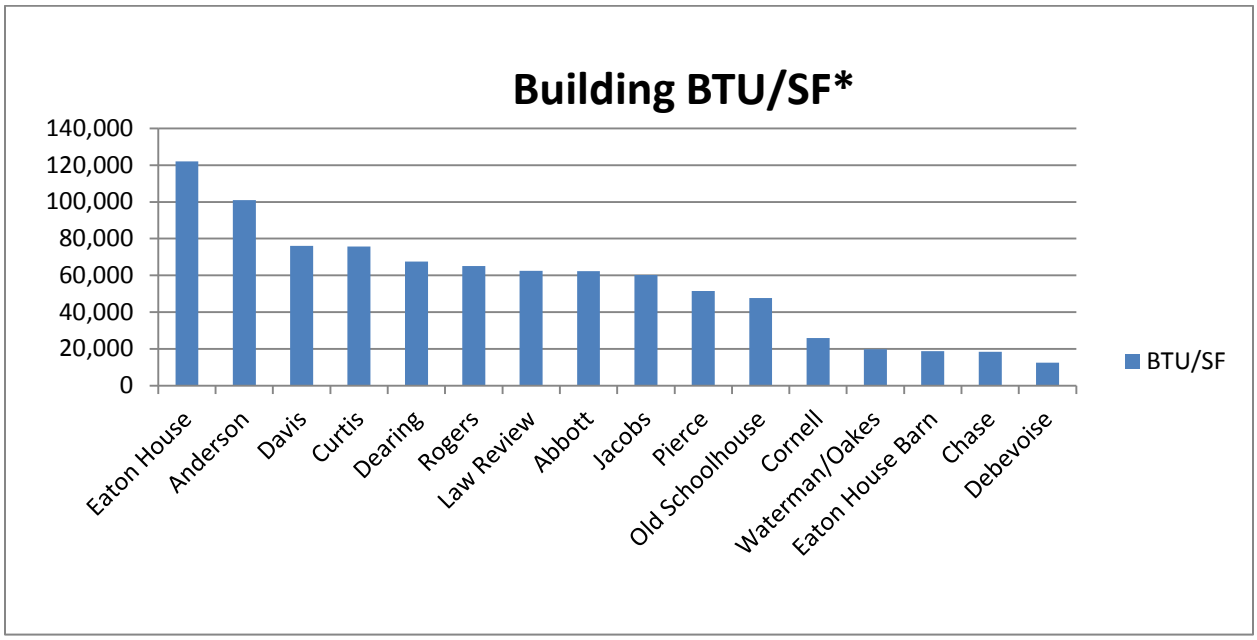
However, these problems are not isolated to these four buildings. All of the buildings on campus besides the Center for Legal Services and Oakes Hall are over 30 years old. Only one of the buildings, Debevoise Hall, has had a comprehensive retrofit that undertook thermal energy efficiency measures.

Fortunately, heating-related emissions are also among the easiest and most cost-effective to reduce. Investments in thermal energy efficiency measures (insulation upgrades and air-sealing) usually have a very quick payback period. This payback period is shortened by the availability of financial incentives from Efficiency Vermont for performing the work as well as the high cost of heating oil.



Measuring building BTU per square foot (BTU/SF) is a simple method of benchmarking a building's performance. This method relies on computing the fuel used to heat a building during the past year and normalizing that fuel use for the size of the building by taking into account weather conditions. The higher the number of BTU's required to heat a certain amount of space in a building, the less efficiently the building's heating and cooling is operating. Looking at

BTU/SF gives a snapshot of how a building is performing relative to other buildings. However, to more accurately determine BTU/SF requires an energy audit. In the 2012 energy audits on 4 buildings, most of the buildings had actual BTU/SF very similar to the projected BTU/SF. Most of the buildings had slightly lower actual BTU/SF ratings than predicted through calculations on paper. However there was one exception: the Eaton House had 122,022 actual BTU/SF and 111,138 projected on paper.



*The BTU/SF measurement for Eaton House, Anderson, Davis and Law Review are all actual measurements from energy audits, the rest are IEE calculations.

Direct Transportation

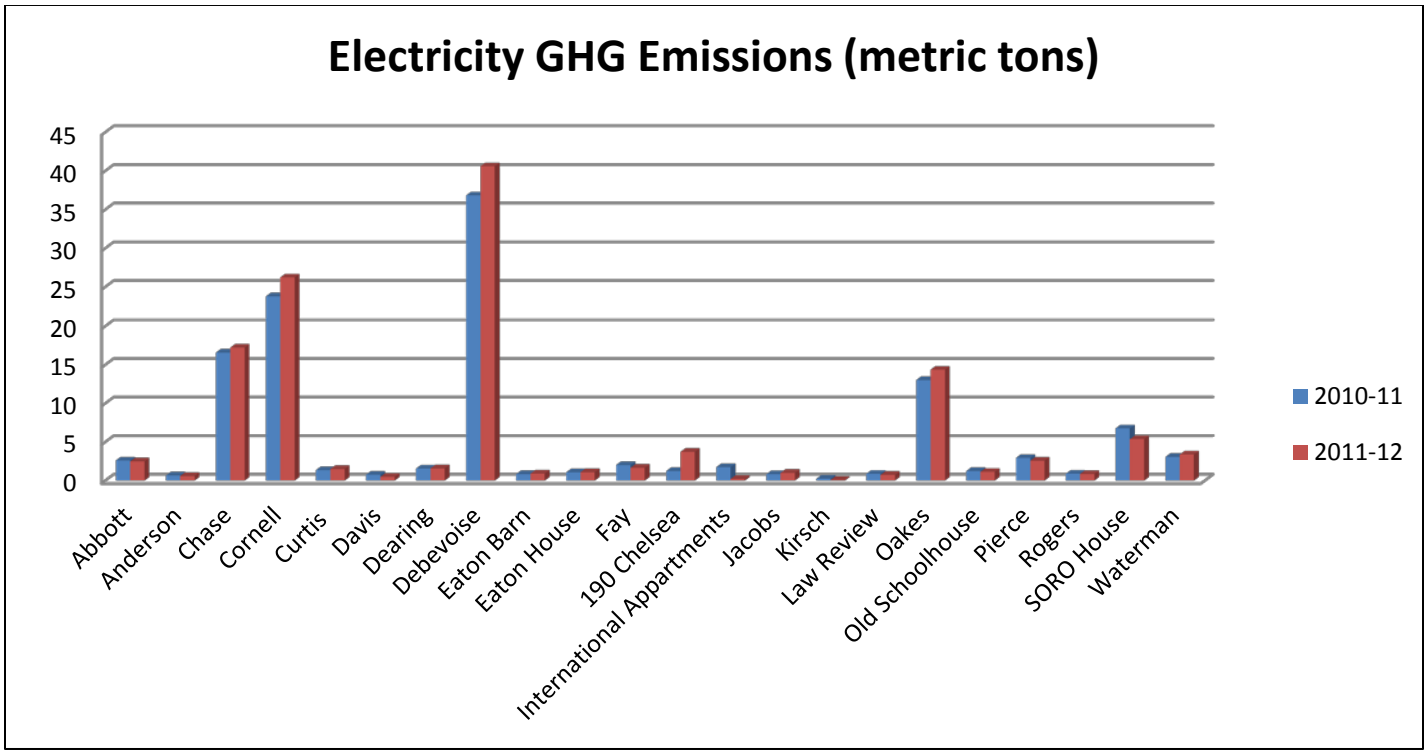
Our on campus vehicle fleet consists of vehicles that Buildings and Grounds uses for lawn care and snow removal. In 2011-12, the only year we could obtain data for, these vehicles used approximately 925 gallons of gas and 259 gallons of diesel annually. This equates to **11** Metric tons CO2. While this may not be a large source of GHG emissions, there are other environmental impacts associated with burning diesel, namely from the impact of particulates.

Scope 2 Emissions

Electric

Electric data was derived from invoices from our electric utility, Green Mountain Power. In 2011-12, VLS used 1,410,570 kWh of electricity, resulting in a total of **128** metric tons of CO2. In the previous academic year, VLS used 1,333,886 kWh of electricity, resulting in a total of 121 metric tons of CO2 emissions. If we look building by building, 80% of all of VLS's electric use results from just 5 buildings on campus: Chase, Cornell, Debevoise, Oakes and Waterman.

Unfortunately, all of these buildings except Chase are on the same electric meter so differentiating the use between them is complicated. However B&G tracked the historical usage of each building and determined that the usage between the four buildings breaks down proportionately as follows: Oakes 17%, Waterman 5%, Debevoise 48% and Cornell 31%.



Debevoise uses the most electricity of any building on campus by far, consisting of 32% of the entire campus's electric use. This is mostly due to the server room in the Debevoise basement. As a result of Hurricane Irene, the server room was damaged and much of the equipment needed replacement. The IT department acquired the new server equipment and began the process of migrating data from the old machines to the new machines. Finalizing the installation of the new system may result in a significant reduction in energy use.

Other large electric users on campus include the computer labs in Chase and the Cornell Library. These computers usually are running 24/7 and currently do not have networked power management. The South Royalton House uses more electricity per sq. ft. than many of the other buildings but that is likely because of food preparation taking place there. During the summer months, many buildings have window air conditioner units.

Vermont Law School has a history of implementing electric efficiency projects in the past with Efficiency Vermont, the state-wide energy efficiency utility. The following chart shows projects that were completed with Efficiency Vermont between 2008 and 2011 and the savings produced:

Project Description	Date Completed	Resource Savings $	kWh Savings	MMBTU Savings
Vermont Law School - CFL Lighting Retrofit	Nov 2008	$2,262	22,875	(21)
Vermont Law School - Old Schoolhouse - Lighting	Apr 2009	$1,733	18,927	(20)
Vermont Law School - Eaton House - Lighting	Nov 2009	$846	9,164	(10)
Vermont Law School - High-Efficiency Boilers	Mar 2010	$396	0	(28)
Vermont Law School - Campus-wide - Screw-base LED	Nov 2010	$624	6,002	(7)
Vermont Law School - Cornell Library - Screw-base LED	Jan 2011	$76	730	(1)
Vermont Law School - Cornell Artwork Lighting	Feb 2011	$673	6,052	(5)
Vermont Law School - Chiller	Aug 2011	$797	9,406	0
Vermont Law School - Server Room - HVAC	Oct 2011	$2,970	25,646	0
	Totals:	**$10,376**	**98,802**	**(63.0)**

The total annual savings from these projects as well as projects completed between 2005 and 2008 have produced 204,167 kWh in savings or about 14.47% of our total electrical usage. However, our usage continues to expand despite these measures, meaning that some more robust efficiency projects may be necessary.

Year	kWh Savings	VLS Savings
2005	99,680	$18,369
2006	2,641	$324
2007	7,084	$693
2008	21,503	$2,262
2009	27,258	$2,578
2010	6,732	$1,096
2011	39,268	$4,440
Total:	**204,167**	**$29,762**

While Vermont Law School total kWh usage is average to high for a school of its size, the resulting GHG emissions are low as compared to other schools around the nation because of Vermont's electric portfolio. Our electrical utility provider is Green Mountain Power (GMP). Historically, two thirds of GMP's electric supply came from Hydro Quebec (32%) and Vermont Yankee (46%). The carbon emissions profile from this generation portfolio was used to calculate emissions from 2010 and 2011. However, the Vermont Yankee contract expired in 2012 and Vermont no longer receives power from Vermont Yankee. Hydro Quebec supplied power will slightly increase. Nuclear power is still supplied from plants in New Hampshire and Connecticut but it is drastically reduced. The remaining 30.8% of our power supply will come from "other" sources, which will most likely be drawn from the regional power market (ISO-NE), which is largely dependent on natural gas and other conventional power sources. Therefore in the future, we may see a slight increase in our emissions factor associated with purchased electricity because much of the carbon-free nuclear power will be shifted to low-carbon natural gas

generation. However, looking at the overall environmental repercussions beyond climate change, this shift away from nuclear power is welcome.

Scope 3 Emissions

School sponsored Travel
The second largest emissions source associated with Vermont Law School derives from institutionally funded airfare. Reviewing the most recent data, Vermont Law School recorded 1,296,683 air miles in 2011, which equals **763** MT CO2e.

We reviewed records of air miles from 2007-2011. However, 2011 was the only year when VLS recorded both the destination city and arrival city. Therefore it was impossible to derive accurate mileage information for years previous to 2011. However, given that the ACUPCC requires reporting on institutionally sponsored air miles, we need to address this data issue in the future.

In addition to emissions from air miles travelled, VLS directly recorded 215,310 car miles in 2011, which is equivalent to **80.2** MT CO2e. Most of this was for car travel from students, faculty, and staff within New England.

Student, Faculty and Staff Commuting
Data for VLS's emissions resulting from student, faculty and staff commuting was primarily derived from a survey issued in spring 2013. The survey sought input on method of travel, commute miles, and trips per week. From this, a weekly and annual total was derived. The response rate of the survey was 24% for faculty, 43% for staff, and 18% for students. To obtain total emissions for those who did not respond to the survey, we averaged out the miles traveled from the rest of that campus group and multiplied it by the number of members who did not respond. Overall emissions from student commuting are 748.1 MT CO2e and faculty and staff commuting is 554.1 MT CO2e, for a combined total of **1302.2** MT CO2e.

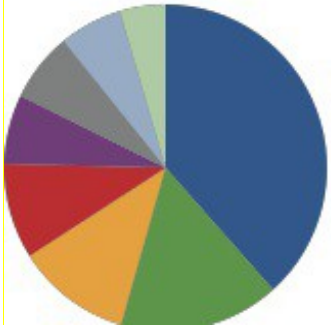
Overall we found that 45.8% of students walked or bike to campus; whereas only one faculty member who responded to the survey reported walking. Six students and one staff member reported regularly taking the bus to campus from Montpelier. 7% of students, and two faculty members reported carpooling at least some of the time. The commute mileage between students, faculty and staff varied considerably. The highest reported commutes were 592 miles per week for a student, 1250 miles per week for a staff member, and 1000 miles per week for a faculty member.

The total distance travelled by students in cars equated to 1,945,369 miles and by bus was 73,402 miles. The average student drove 2,702 miles per academic year (including those who walk) to commute to school. The total miles travelled by faculty members in cars were 548,345. The average faculty member drove 8,704 miles per year to commute to campus. The total distance travelled by staff members was 865,639 miles in cars and 12,000 miles by bus. The average staff member drove 8,494 miles per year, very close to the number for faculty.

VLS's commuting emissions are high because we have a rural campus that lacks on-campus housing, and is limited in public transportation except for those commuting from Montpelier. Many faculty and staff members choose to live in larger towns a fair distance away.

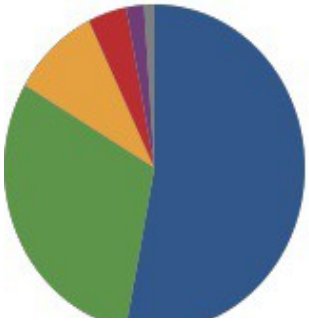
Spring 2012 Commuting Survey

How far do you live from VLS?



- 38.3% Under 1 mile (134)
- 16.0% 1- 5 miles (56)
- 11.4% 5- 10 miles (40)
- 9.4% 15- 25 miles (33)
- 6.8% 10- 15 miles (24)
- 6.3% 25- 35 miles (22)
- 4.5% 35- 45 miles (16)
- 6.8% 45 miles or more (24)

How did you get to VLS today?



- 53.0% Drove alone (192)
- 30.3% Walked (110)
- 9.3% Carpooled/dropped off (34)
- 4.1% Biked (15)
- 1.9% Stagecoach (7)
- 1.1% "Other" Answers

Agriculture

Vermont Law School currently does not have any agriculture on campus. While an arboretum and landscaping is maintained on campus, currently no fertilizer is used according to B&G. Therefore there are no measurable agricultural emissions.

Trash and Recycling

VLS's trash production amounts to 6 tons per month. It is a little difficult to say where the trash goes beyond this point. There are two active landfills in Vermont in Coventry and Moretown. Both of these facilities use the landfill gas that is produced to generate electricity. Regardless, the CA-CP calculator assigns a negative value for waste that goes to a landfill gas to energy facility. Here the CA-CP calculator gives a figure that the total resulting emissions are -2.2 MT CO2e if the landfill gas is turned into electricity. This negative emissions factor may be derived by comparing the emissions that would result if we had deposited the waste in a solid landfill. However there are sizable emissions from landfill gas to energy facilities that result from leaked methane gas and from the burning of landfill gas for electrical generation, or the flaring of excess gas. Moreover, a recent report from the Sierra Club illustrated that landfill gas to energy facilities actually have greater GHG emissions than standard flaring landfills because of the greater

amount of leaked methane.[8] Therefore we chose to use the emissions factor associated with a standard methane flaring landfill, which is a positive number, and we recognize that the actual emissions may be higher. The total emissions from trash are **22.3** MT CO2e. The IEE was unable to determine our resulting GHG emissions from recycling because our recycled materials are not measured and, according to B&G, would be very difficult to measure.

Food

Food services are currently provided by an outside vendor, Fitz Vogt. Fitz Vogt has a contract to provide services at the VLS Café and at events throughout the school year. During the growing season, Fitz Vogt is contractually required to provide 85% local food. Most of this food comes from small farms in Vermont. During the winter, Fitz Vogt acquires food from several suppliers including Black River Produce. While companies such as Black River Produce strive to acquire as much local food as possible, the bulk of their food outside of the growing season comes from the Boston conventional wholesale market.

Calculating emissions from food service can be achieved with the CHEFS emission tool. Currently we would need to collect additional information to analyze emissions under CHEFS including weight of raw ingredients purchased, method of agricultural production, and point of origin and are thus unable to specifically calculate the emissions at this time. However, on a global level, agricultural emissions are 30% of the total GHG emissions, thus there are likely sizable GHG emissions from VLS's food choices.[9]

Refrigerants

Any GHG emissions from refrigeration at VLS are de minimis according to B&G.

Wastewater

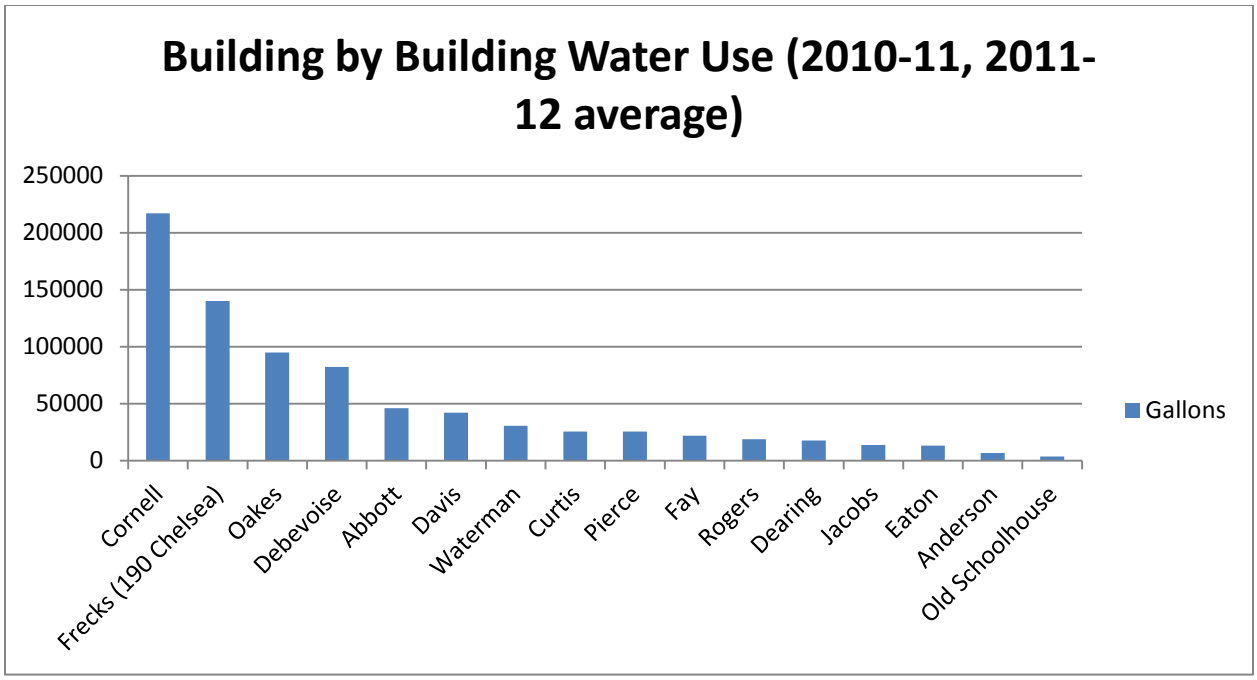
In 2011-12, VLS used 980,700 gallons of water that returned to the sewers (our water bill shows 402,800 usage), which is equivalent to **0.5** MT CO2e. In 2010, VLS sewer data shows a use of 660,600 gallons of water (water bill shows 1,037,800 gallons), which emits 0.3 MT CO2e. The reason why the water bill and the sewer bill do not line up is because they are read at different times of the year and handled by separate entities. The water bill is read in April, whereas the sewer bill is read in June and December.

Our wastewater is treated at the Royalton Wastewater Treatment Facility, which uses an aerobic 3 lagoon system to handle VLS's discharges. The aerobic system has far less carbon emissions than anaerobic wastewater systems.

The Cornell library uses the most water on campus. This is largely due to the fact that it is widely utilized and open the most hours of any building on campus and because it only offers standard flush toilets. Surprisingly, the 190 Chelsea building used the second most amount of water but the use of that building has since changed and we expect the data to be different in future years.

[8] *See* http://www.sierraclub.org/policy/conservation/landfill-gas-report.pdf

[9] Tara Garnett, *Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)?*, FOOD POLICY 1 (2010).



Paper

According to B&G, VLS orders 1,600 cases of computer paper annually. A case consists of 5,000 sheets of paper. This totals 8,000,000 individual sheets of paper. 1,300 cases are paper containing 30% recycled content and the remaining 300 cases contain 100% recycled content paper. The total emissions from computer paper are **95.7** MT CO2e.

VLS currently has a sophisticated system for measuring computer paper consumed. In monthly reports, the installed software displays total sheets consumed in that month, the most heavily used printers, the individuals printing the most, and the resulting GHG emissions from printing. For the months of November and December 2012(including Christmas and Thanksgiving break), the total was 237,947 sheets printed or 3,837 sheets per day. The top printing locations were the library lab, which printed 26.5% of the total sheets and Chase lab, printing 19.55% of the total sheets.

In addition to computer paper, VLS uses paper towels in many of the bathrooms. The monetary cost for these paper towels is $2600 year. They consist of 75% post-consumer recycled content and 15% recycled content paper towels. Presently B&G does not have a weight or volume measurement available, so we cannot measure the GHG emissions from bathroom paper towels.

Transmission and Distribution Losses

Transmission and Distribution Losses are emissions that result from increased electrical generation that is necessary to bring electricity from a power plant to campus. In the U.S., on average about 7% of the electricity is lost between sources of supply and points of distribution to consumers. This is considered a scope 3 emission because it is closely related to the electricity that we actually consume. In 2010-11, this amounted to 44.1 MT of CO2e. In 2011-12, this increased to **46.7** MT CO2e.

Carbon Offsets

VLS currently does not have any carbon offsets. However, VLS does have a food scrap composting program, which produces roughly 120 gallons of compost per month. In addition, VLS has currently installed a net-metered solar charging station that will mitigate 5.06 MT CO2e of carbon per year once installed (not included in total emissions for 2011-12).