



GMC Greenhouse Gas Emissions Inventory FY 2013

Overview

Green Mountain College (GMC) completed its fourth greenhouse gas (GHG) emissions inventory in August of 2013. This study assessed emissions from Fiscal Year 2013 (July 1st, 2012 to June 30th, 2013). Data were compared with data from prior inventories, including FY 2011, FY 2009, and FY 2007. Between FY 2007 and FY 2011, GMC reduced its emissions by 1,648 metric tons of carbon dioxide equivalent (CO₂e) in line with the American College and University Presidents' Climate Commitment's (ACUPCC) preference for reducing and replacing before offsetting. After the reduction in actual emissions, the College purchased third-party verified carbon offsets from the Cow Power program run by CVPS (now Green Mountain Power) in order to reach the goal of climate neutrality. GMC became the second college in the country to achieve neutrality and the first to do so through a comprehensive approach which included construction of a \$5.8 million biomass plant, and over \$1 million in efficiency measures. Since 2011, the College has maintained neutrality through offsets from the Cow Power program and has continued the effort to reduce actual emissions from 3,999 to 3,682 metric tons of CO₂e.

Fig. 1: 2013 Emissions Summary

Emissions Source	MT CO₂e
Scope 1	1707
Scope 2	775
Scope 3	1200
Total Emissions	3682
Offsets	-4205
Net Emissions	-523

Methods for Generating Inventory

All four of GMC's GHG inventories (2007, 2009, 2011, 2013) account for emissions within the fiscal year (e.g. July 1st 2006 to June 30th of 2007 represents fiscal year 2007). All studies used the Clean Air-Cool Planet calculator to make the final GHG emissions conversions from raw units used under the different scopes. The calculator estimates emissions from all six greenhouse gases specified by the Kyoto Protocol (CO₂, CH₄, N₂O, HFC and PFC, and SF₆) and then converts them into metric tons of carbon dioxide equivalent (CO₂e). The calculator's coefficients are consistent with the GHG Protocol for GHG accounting by the World Business Council for Sustainable Development and the World Resources Institute, an established standard in the field of higher education GHG accounting. The carbon dioxide equivalent values used in the calculator are consistent with the 4th Assessment of the IPCC. The Clean Air-Cool Planet calculator serves as the norm for GHG reporting to the ACUPCC.

For stationary and mobile fuel sources owned by the College, data were gathered by tallying gallons of different fossil fuels and short tons of woodchips purchased. Waste data were also tallied in short tons. Electricity data were comprised of kWhs purchased by the utility company. Finally, directly financed travel data were input by passenger miles and were partially collected through a survey of students, staff, and faculty. When possible, these data were estimated based on actual travel records.

Previous inventories used different versions of the CA-CP calculator (v5.0 in 2007, v6.1 in 2009, and v6.6 in 2011). For the 2013 inventory, version 6.9 was used. For consistent comparison, all inputs from previous inventories were plugged into version 6.9, and all numbers reported here use version 6.9.

Standard reporting practice classifies GHG emissions by “scopes” which are defined in the ACUPCC Implementation Guide as follows:

Scope 1: Refers to direct GHG emissions occurring from sources that are owned or controlled by the institution, including: on-campus stationary combustion of fossil fuels; mobile combustion of fossil fuels by institution owned/controlled vehicles; and “fugitive” emissions. Fugitive emissions result from intentional or unintentional releases of GHGs, including the leakage of HFCs from refrigeration and air conditioning equipment as well as the release of CH₄ from institution-owned farm animals.

Scope 2: Refers to the indirect emissions generated in the production of electricity purchased by the institution.

Scope 3: Refers to all other indirect emissions; those that are a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution. Though ACUPCC signatories are only required to report on commuting and air and ground travel sponsored by the institution (e.g., study abroad programs, faculty travel to conferences, staff driving to meetings, etc.), GMC has made every effort to quantify other scope 3 emissions for this inventory. As such, the College has also calculated emissions related to the disposal of solid waste, application of organic fertilizers including manure generated by campus-owned livestock, and boarding of livestock. In addition, results from 2009, 2011, and 2013 also account for emissions lost in the transmission and distribution of electricity (indicated as “T&D”) in scope 3 instead of scope 2, where they were counted in the 2007 inventory. As other scope 3 emissions outlined in the calculator were determined by best estimates to contribute less than 5% of GMC’s total emissions, they have been designated as *de minimis*, or small sources, and are not included in this report (e.g. fugitive emissions from refrigeration and other chemicals on campus). Designation of these sources as *de minimis* follows standards established by the ACUPCC in its Implementation Guide.

Limitations

The GMC Sustainability Office has been responsible for collecting the data necessary for this report since 2009. In 2007, the report was produced through collaboration between the sustainability office and Professor Steve Letendre.

The majority of the data used for the inventory come from actual units of fuel or kWhs purchased. However, some data are estimated, most notably, those required for scope 3 transportation. In the spring of 2013, an online survey was emailed to all faculty, staff, and students to capture their commuting patterns. Additionally, workers sat in the student center and asked passersby to fill out the survey. The survey provided the most detailed data to date on commuting patterns both because the response rate was over

40% (N=415) and because respondents could provide their commuting mode choice at the daily level, their vehicle make, and the number of months they commute throughout the year. Previous surveys asked broader questions and did not yield as high of a response rate, so past estimates show some large fluctuations that don't necessarily correspond to population size, especially FY 2011.

Emissions from directly-financed business travel have also fluctuated over time because the methodology for estimating this has varied. Past inventories relied exclusively on the commuting survey instrument to capture staff and faculty business trips. The FY 2013 inventory relied on the survey instrument for most departments, with the exception of the two most significant contributors to emissions (athletics and admissions)¹. Athletics and admissions data were estimated more directly by examining records of expenditures to find actual destinations and modes used. Given that these two departments represent more than 50% of all estimated mileage, the sustainability office is confident that FY 2013's inventory provides the most accurate estimation of business travel to date. Regardless, these changes in methodologies do not have a significant impact on the reliability of the total emissions estimates. The goal of GMC's GHG emissions reporting is to produce the best snapshot possible to highlight emissions production related to Scopes one, two, and three.

Agricultural emissions also show noticeable fluctuations over time because of different interpretations of whether to count livestock manure as fertilizer. In the past, this manure management has been considered part of the livestock head count reported elsewhere in the calculator. For FY 2013, the decision was made to report applied manure in the fertilizer section after consultation with CA-CP staff. From now on, applied manure and livestock will be reported separately as the two represent a more robust picture of GMC's GHG emissions. For sake of comparison, all the normed emissions numbers reported from past years in this report include estimates of past manure applications based on animal head count and consultation with Cerridwen farm staff.

Past emissions estimates in all three categories have changed slightly during every new inventory due to updates for GHG coefficients within the CA-CP calculator. The most notable example in FY 2013 is the increase of over 100% in waste-related emissions.

Detailed Results & Analysis

GMC continues to improve the campus to reduce emissions, through energy efficiency measures, campaigns to make sustainable transportation the preferred method of travel and upgrades to the waste diversion systems. The following table shows how emissions have changed over time in specific categories.

¹ Both commuting and business-travel survey data were scaled up to the full population size (excluding the admissions and athletics population under business travel)

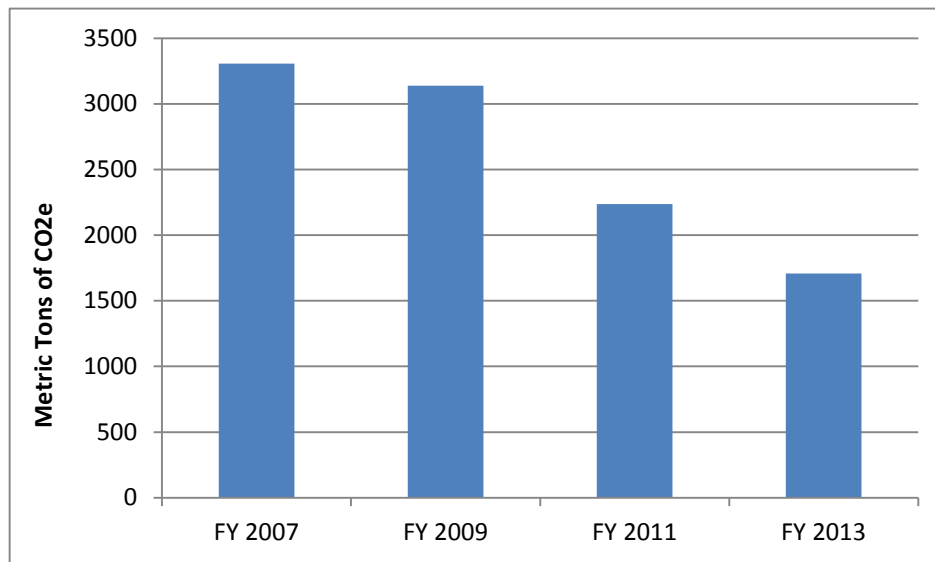
Fig. 2: Emissions by Source (All inventories normed to v.6.9 of the CA-CP calculator)

	2007 CO2e (MT)	2009 CO2e (MT)	2011 CO2e (MT)	2013 CO2e (MT)
Scope 1 Emissions				
Stationary Fuel (heating & cooking)	3229	3060	2149	1608
Campus Fleet Fuel	61	56	62	70
Agriculture	16	21	25	29
Scope 1 Subtotal	3305	3138	2236	1707
Scope 2 Emissions				
Purchased Electricity	869	783	822	775
Scope 3 Emissions				
Commuting	317	369	100	352
Ground Travel	36	46	31	127
Air Travel	126	171	157	99
Study Abroad	327	202	41	114
Solid Waste	580	636	530	431
Electricity (transmission & distribution losses)	86	78	81	77
Scope 3 Subtotal	1473	1501	941	1200
Total Emissions	5647	5422	3999	3682
Offsets				
On Farm Compost		-1	-3	-5
Cow Power RECs (renewable energy credits)	-330	-433		
Certified Offsets purchased from GMP (formerly CVPS)			-5800	-4200
Net Total Emissions	5317	4988	-1804	-523

Scope 1

Every year the College increases the efficiency of the central heat and power biomass plant. Improvements include upgrades to steam pipe components and more efficient operation methods. These actions have a noticeable impact on the total scope one emissions over time. The following graph shows scope one totals for two inventories before the plant was built (FY 2007 and FY 2009) and two inventories since the plant was built (FY 2011 and FY 2013).

Fig 3: Scope 1 emissions (including heat and hot water) over time



Scope 2

In 2012, the College started a \$30,000 green revolving loan fund, which has already completed its first two projects: replacement of all 80 outdoor lamp post lights with LEDs and construction of a 5.8 kW solar charging station for electric vehicles. Over the last three years, a suite of small electric efficiency projects have added to a projected 7.5% reduction in electricity use, for which the College has met Efficiency Vermont's Energy Leadership Challenge in 2013. Gains in efficiency have been made despite an overall growth in the square footage of campus buildings. The College has also begun construction of a 148 kW solar project on campus.

Scope 3

A general downward trend in scope three emissions can be observed with FY 2011 being an anomaly. Commuting emissions are on par with previous years, with the exception of FY 2011. The apparent discrepancy in 2011's data is explained in the limitations section. The sustainability office is confident that FY 2013's estimate is the most accurate estimate to date. The unexpected increase in directly-financed ground travel in FY 2013 compared to prior years is most likely a function of a change in methodology as described above in the limitations section. However, the sustainability office believes that FY 2013's estimate for ground travel is also the most accurate to date given that over 50% of the estimated mileage was captured directly from the responsible departments rather than coming exclusively from the transportation survey. Air travel emissions for general business have dropped. The study abroad emissions have followed a similar trend, with the exception of FY 2011. It is important to note that even a dozen long distance trips can skew the numbers given the College's small population size and the high GHG intensity

of airplanes. After norming previous years using the FY 2013 calculator's new coefficients, solid waste emissions have gone down as tonnage of landfilled material has decreased from 187 in 2007 to 123 in 2013. From FY 2009 onward, total electricity use has decreased and the electric grid has increased in efficiency, resulting in a drop of the total emissions from transmission and distribution losses.

Offsets

The College has maintained climate neutrality since 2011 through a partnership with Green Mountain Power's Cow Power Program which offered the College carbon offsets, reported in the calculator as "retail high-end offsets." To acquire the offsets, the College paid a premium on 50% of its electricity use in FY 2011 and FY 2012, and on 25% in FY 2013. The premium paid on electricity use went to Blue Spruce Farm in Bridport, Vermont, to fund a process of cow manure collection and digestion, where the resulting methane capture was used to create electricity. The offsets are based on the methane destruction from this process. They have been verified by the third party Agri-Waste Technology, Inc. and were retired on the Chicago Climate Exchange.

The complete inventories for FY 2011 and FY 2013 explained in this report outline the number of offsets applied to cover the College's emissions for those years (see the table above). For the interim year of FY 2012, a nearly complete inventory was carried out to ensure neutrality was maintained. In building the inventory, the sustainability office used all available data that could easily be procured, including woodchips, heating oil, gasoline, diesel, electricity, and solid waste. Other inputs had to be estimated based on trends, and in most cases the average between FY 2011 and FY 2013 was used. Categories that were estimated included livestock, fertilizer, commuting, and directly-financed transportation. Estimated emissions for FY 2012 totaled 3,931 metric tons of CO₂e, a number that is between FY 2011 and FY 2013, suggesting that it is a reasonable approximation. 4,700 metric tons of Cow Power offsets were applied to FY 2012, along with 3 tons of on-campus compost offsets, bringing the net total to -772. To account for any potential underestimates of emissions or spillage from offset creation, more than enough offsets were applied to all of the last three years as illustrated in the table above. GMC is confident that it has maintained climate neutrality consistent with ACUPCC standards.

The College is committed to continuing the trend of reducing actual emissions on campus in order to further minimize the need to purchase offsets. GMC's new strategic plan, *Sustainability 2020*, aims to achieve authentic sustainability by the year 2020. The plan challenges the College to produce all of its energy on campus by renewable resources, increase the waste diversion rate to above 50%, and begin inventorying the upstream GHG emissions from supplies purchased by the College with the goal of decreasing those indirect emissions through more strategic purchasing decisions.