Colgate University's 2013 Greenhouse Gas Inventory

A step-by-step guide to completing a greenhouse gas inventory at Colgate University

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LIST OF ACRONYMS/ABBREVIATIONS

Acronym	Meaning
AASHE	Association for the Advancement of Sustainability in Higher Education
ACUPCC	American College and University Presidents' Climate Commitment
B&G	Colgate's Buildings and Grounds Department
BoHP	Boiler Horsepower
Ca-CP	Clean Air – Cool Planet
CAP	Climate Action Plan
CH_4	Methane
CO2	Carbon Dioxide
COVE	Colgate's Center for Outreach, Volunteerism, and Education
MTeCO2	Metric Tons of Carbon Dioxide Equivalents
U.S. EIA	United States Department of Energy: Energy Information Administration
ENST	Colgate's Environmental Studies Program
U.S. EPA	United States Environmental Protection Agency
FSEM	Colgate's First-year seminar
FTE	Full-time Equivalent Student
FY	Fiscal Year (July 1 to June 30)
GHG	Greenhouse Gases
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
HCFC	Hydrochlorofluorocarbon
IRS	Internal Revenue Service
Kg	Kilogram
kWh	Kilowatt-hour
Lbs	Pounds
N2O	Nitrous Oxide
NSF	National Science Foundation
PFC	Perfluorocarbons
PPA	Power Purchase Agreement
RECs	Renewable Energy Credits
SF6	Sulfer Hexafluoride
WBCSD	World Business Council on Sustainable Development
WRI	World Resources Institute

EXECUTIVE SUMMARY

This report provides the methods and results of Colgate University's 2013 Greenhouse Gas Emissions Inventory. The Inventory was completed in compliance with one of the key requirements of the American College and University President's Climate Commitment (ACUPCC)–with support from President Jeffrey Herbst. The data gathered follows the protocol specified in the ACUPCC Implementation Guide and the calculations were made using emissions factors from the Clean Air-Cool Planet Campus Carbon Calculator v6.9, also recommended in the ACUPCC guidelines. This is our fifth consecutive year completing Colgate's greenhouse gas inventory. Colgate's greenhouse gas emissions were 17,353, 14,505, 16,194, 13,817, and 13,841 metric tons of carbon dioxide equivalent (MTeCO2) for the years 2009, 2010, 2011, 2012, and 2013, respectively. Colgate's inventory of emissions includes all Scope 1 emissions (on-campus stationary combustion of fossil fuels for space heating and domestic hot water, vehicle fleet emissions, fugitive refrigerant chemicals, and emissions associated with grounds maintenance) and Scope 2 emissions (purchased electricity). Scope 3 emissions include faculty and staff commuting, bus commuting (Colgate Cruiser), air travel (paid by or through the university), landfill waste, and paper use.

Compared to Colgate's 2009 baseline inventory, the university decreased its emissions by 3,512 MTeCO2 (from 17,353 in 2009 to 13,841 in 2013), or by 20.2 percent. Emissions increased slightly in FY 2013 (13,841 MTeCO2) compared to FY 2012 (13,817 MTeCO2). This was due to an increase in fuel oil consumption as the result of a much colder and windier heating season. Despite this marginal increase, FY 2013 marked a year of positive trends. Colgate's continuing drop in emissions associated with our vehicle fleet, refrigerant use, fertilizer use, electricity consumption, commuting, business travel, and paper use is due to the ongoing implementation of effective behavior change programs, numerous energy conservation and efficiency projects, and meticulous implementation of the projects and policies specified in our 2011 Sustainability and Climate Action Plan (S-CAP).

Specific projects implemented in FY 2012 and FY 2013 that are contributing to reduced emissions include the continued purchase of large volumes of tree-free paper from EcoCampus, LLC and a new policy to purchase only recycled paper on campus. This policy led to a dramatic rise in the amount of 100% recycled paper usage. During the summer of 2012, Colgate also completed the installation of an additional 455 low-flow showerheads throughout campus. This project reduced our water consumption and the necessary energy to heat the water. We also installed LED lighting in Love Auditorium, purchased four new bikes for our Green Bikes Program, expanded our reduced mowing program to include the old golf course, and completed the renovation of Lathrop Hall to meet green building standards (official LEED certification pending). Additionally, Colgate conducted a survey of its forested lands in FY 2013 and determined that 1,239 tons of carbon are sequestered annually.

In FY 2013, Colgate utilized a few carbon offset programs to reduce its net carbon output. As in FY 2012, carbon sequestered through the growth of newly planted native trees in Patagonia, Chile through our partnership with Patagonia Sur, LLC offset 5,000 tons of carbon emissions. Additionally, renewable energy credits (RECs) purchased through Sterling Planet offset the emissions associated with our electricity consumption. Between these two offset projects and the sequestration of carbon by Colgate's forested land, a total of 7,932 tons of carbon emissions were offset. As a result, the university's net footprint in FY 2013 is 5,909 MTeCO2. Colgate's 2013 gross emissions were 2.02 MTeCO2 per full-time student and 2.55 MTeCO2 per 1,000 square-feet of building space. This is a reduction of 3.76 MTeCO2 per student and 4.35 MTeCO2 per 1,000 square-feet when compared to our 2009 baseline inventory. Colgate's highest sources of emissions were found to be on-campus stationary combustion of fossil fuels (e.g., fuel oil, kerosene, and propane) at over a third of our emissions.

INTRODUCTION

The ACUPCC and Colgate's Commitment to Climate Neutrality

The American College and University Presidents' Climate Commitment (ACUPCC)[1] was officially announced in October 2006 during the AASHE[2] conference at Arizona State University. Signatories make a commitment to "*achieve climate neutrality as soon as possible"* by eliminating or offsetting 100 percent of the institution's greenhouse gas emissions. One mandatory component of the ACUPCC is to complete a greenhouse gas emissions inventory as specified in the pledge[3] under step 1, part b:

> *"Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter."*

By March 31, 2007, 152 presidents and chancellors became charter signatories of the ACUPCC. By 2014, there were 679 signatory institutions from all 50 states representing over 6 million students.

In 2009, Colgate University signed the ACUPCC and completed our first comprehensive greenhouse gas inventory[4]. Even though the ACUPCC requires an update to the inventory every other year, for tracking and consistency purposes, we felt it was important to complete the inventory on an annual basis. This is our fifth consecutive year completing Colgate's greenhouse gas inventory. Colgate's greenhouse gas emissions were 17,353, 14,505, 16,194, 13,817, and 13,841 metric tons of carbon dioxide equivalent (MTeCO2) for the years 2009, 2010, 2011, 2012, and 2013 respectively. Throughout this report, we provide the results of Colgate's 2009-2012 inventories; however, our focus here is on the 2013 inventory. More specifically, the goals of this report are to: 1) meet a key requirement of the ACUPCC by tracking progress compared to our 2009 baseline inventory, 2) highlight the methodology and results of Colgate's 2013 Greenhouse Gas Inventory, and 3) provide step-by-step instructions explaining how to collect the inventory data and make the calculations so this report can serve as a guide for future inventories.

Striving for and achieving climate neutrality is a significant commitment that further demonstrate's Colgate's leadership in advancing the practice and teaching of sustainability. Colgate has already made significant progress towards climate neutrality, as we have reduced our net greenhouse gas footprint by 10,196 MTeCO2 (or by more than 60 percent) since 2009.

Conservation and efficiency is saving the university over $500,000 annually in operating costs while enhancing our liberal arts education as student participation is integral to these results through academic research, governance, and co-curricular student group activities.

Additionally, in April of 2010, Colgate's faculty officially approved the goals of a Colgate education. Among them, they specified that a Colgate education should enable students to, *"recognize their individual and collective responsibilities for the stewardship of the earth's resources and the natural environment"* and graduate as *"engaged citizens who strive for a*

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[1] ACUPCC Website: http://www.presidentsclimatecommitment.org/

[2] Association for the Advancement of Sustainability in Higher Education website: http://www.ashe.org/

[3] ACUPCC Implementation Guide accessed online at: http://www2.presidentsclimatecommitment.org/pdf/ACUPCC_IG_Final.pdf

[4] Colgate University's 2009 Baseline Greenhouse Gas Inventory can be accessed online at: http://www.colgate.edu/docs/d_distinctly-colgate_sustainability_climate-action-planning/download-the-full-report-11-27-12.pdf?sfvrsn=2

just society." To meet these ends, Colgate offers over 40 courses per semester related to or focused on sustainability and climate change.

On September 15, 2011, the Sustainability Office published Colgate's Sustainability and Climate Action Plan[5]. The plan details a set of specific, measurable, and tangible goals to achieve climate neutrality by Colgate's bicentennial celebration in 2019–an ambitious target date. Colgate's updated greenhouse gas inventories (including this one) will track our progress towards that goal.

As a result of our climate action planning efforts, Colgate was honored with Second Nature's 2011 Climate Leadership Award[6]. With our wood-fired boiler, low-carbon electricity grid, sustainability-focused academic programming, and a campus culture that promotes sustainability, Colgate is well-positioned to continue as a leader in sustainability in the 21st century.

[5] Accessed online at: https://sites.google.com/a/colgate.edu/2011-2015-sustainability-and-climate-action-plan/

[6] http://secondnature.org/blog/20110623/colgate-university-recognized-climate-leadership

UNDERSTANDING COLGATE'S GREENHOUSE GAS INVENTORY

According to the United States Environmental Protection Agency (U.S. EPA), a greenhouse gas inventory is an accounting of greenhouse gases (GHGs) emitted to or removed from the atmosphere over a period of time. Colgate's comprehensive greenhouse gas inventory is an essential step of continuing to track our emissions over time. Understanding the basic concepts and calculations of the inventory is not only important for the individuals carrying out the methodology, but is also important for anyone interested in what the inventory is telling us and how the results were derived.

Colgate's Greenhouse Gas Inventory quantifies our institution's contribution to global climate change by revealing our net greenhouse gas emissions (total emissions minus the sum of our offsets). Offsets can be any process or activity that removes greenhouse gases from the atmosphere (e.g., methane capture and recovery, forestry-based carbon sequestration, composting, and others) or any strategy that increases the amount of energy produced from clean, renewable sources (e.g., investing in wind energy or solar photovoltaic arrays or other renewable energy technologies). Because Colgate is committed to climate neutrality, the goal is to balance our greenhouse gas budget at zero where total emissions equal total offsets. Once armed with a greenhouse gas budget, the Colgate community can make informed decisions on how to reduce our emissions and increase our offsets. This was the purpose of our Sustainability and Climate Action Plan published in September 2011.

INVENTORY BOUNDARIES

Colgate, like other ACUPCC signatory institutions, follows the international protocol established by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI)[7] and the Climate Registry's General Reporting Protocol[8]. The *ACUPCC Implementation Guide* outlines these protocols as they relate to higher education institutions. Complying with these protocols, we have established the following boundaries when conducting Colgate University's Greenhouse Gas Inventory.

Fiscal Year

Colgate's Greenhouse Gas Inventory tracks emissions over the fiscal year (as opposed to calendar year or academic year). Colgate's fiscal year runs from July 1 through June 30 of each year. Throughout this report, whenever a year is mentioned (e.g., 2013) we are referring to the fiscal year unless otherwise noted. Also, "fiscal year" is sometimes abbreviated to "FY" throughout this report.

Scope of Emissions

Sources of greenhouse gas emissions are organized into three categories called "scopes" as established by the World Resources Institute and followed by the Clean Air-Cool Planet (CA-CP) Campus Carbon Calculator[9]. The three-scope format ensures that there is consistency in measurement between institutions. The scopes are essentially levels of how directly Colgate is responsible for various sources of emissions. For example, travel carried out by Colgate's own fleet of vehicles is categorized as "Scope 1" emissions because Colgate has complete control over what vehicles we decide to purchase and our driving behavior. On the other hand, faculty and staff commuting to and from campus are considered "Scope 3" because Colgate is not responsible for the decisions employees make in purchasing neither their private

[7] See the Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard for additional details. Website: http://www.ghgprotocol.org/files/ghg-protocol-revised.pdf

[8] Website: http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/

[9] Accessed online at: http://www.cleanair-coolplanet.org/toolkit/inv-calculator.php

vehicles nor in their commuting behaviors. The three scopes of greenhouse gas emissions recorded in Colgate's Inventory are as follows:

- Scope 1 Emissions. Scope 1 refers to direct GHG emissions occurring from sources that are owned or controlled by the institution. At Colgate, this includes on-campus stationary combustion of fossil fuels (such as fuel oil #6, fuel oil #2, kerosene, and propane), vehicle fleet emissions, fugitive refrigerant chemicals, and emissions associated with grounds maintenance.
- Scope 2 Emissions. Scope 2 refers to indirect emissions generated in the production of electricity consumed by the institution. To calculate these emissions, we have to determine how our electricity is produced (e.g., hydroelectric, coal, wind, etc.) and calculate the rate of greenhouse gas emissions associated with each source.
- Scope 3 Emissions. Scope 3 refers to all other indirect emissions – those that are a consequence of activities of the institution, but occur from sources not owned or controlled by the institution. Colgate's Scope 3 emissions include faculty and staff commuting, bus commuting (Colgate Cruisers), air travel (paid by or through the university), paper use, and solid waste.

De Minimus Emissions

Colgate is a residential campus with only 250 students (9 percent of population) renting apartments or houses that are not affiliated with the university. The students who do not live in Colgate housing tend to rent apartments or homes within a three-mile radius of campus. The vast majority of students live within walking distance of class. More specifically, all first-year and sophomore students live in residence halls on campus. Junior and senior students either live in University Apartments, the Townhouses, Broad Street houses, or off campus and share rides in automobiles. Emissions associated with this activity are minimal since the distances to campus are so short and students frequently take the Cruiser (free shuttle bus) walk, or ride a bike as an alternative. Additionally, students are not permitted to park their vehicles "up the hill" on campus between the hours of 8:00 AM and 3:30 PM on weekdays. For all of these reasons, we assumed that greenhouse gas emissions associated with student commuting are de minimus (less than 5 percent of gross emissions), and therefore, not required for reporting under the ACUPCC guidelines. As a result, student commuting is not included in Colgate's Greenhouse Gas Inventory.

Operational Boundaries

In compliance with the international and ACUPCC guidelines, Colgate University tracks each of the six greenhouse gases covered under the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). Colgate is required to account for and report all Scope 1 and Scope 2 emissions. In addition, Colgate is required to report Scope 3 emissions from air travel (paid by or through the university) and employee commuting to and from campus.

Organizational Boundaries

In order to calculate Colgate's greenhouse gas emissions, it is necessary to determine the organizational boundaries. Following the Greenhouse Gas Protocol, Colgate defined its organizational boundary by using the operational control approach. As a result, emissions associated with auxiliary services such as the leased buildings incorporated under the for-profit Hamilton Initiative, LLC (e.g., The Barge, the Colgate Bookstore, the Colgate Inn) are not accounted for in Colgate's Greenhouse Gas Inventory because the utilities are not directly managed or serviced by Colgate employees.

INVENTORY CALCULATIONS

Global Warming Protocols

Global warming potentials (GWPs) are measures of each greenhouse gas's influence to warm the Earth's atmosphere (called radiative forcing). The greater the GWP, the more potent the greenhouse gas (Table 1). Carbon dioxide is used as the standard for which the other greenhouse gases are compared (hence the term carbon dioxide equivalent), and therefore, has the global warming potential of one. Methane has a global warming potential of 25 and nitrous oxide is more powerful yet with a global warming potential of 298. Because methane has a global warming potential of 25, it means that one kilogram of methane has a radiative forcing that is 25 times greater than one kilogram of carbon dioxide over a 100 year period.

Table 1. *Global Warming Potentials for Colgate's 2013 Greenhouse Gas Inventory*

Greenhouse Gas	100-Year GWP
CO2	1
CH4	25
N2O	298
HFC-134a	1,430
HCFC-22	1,810

Metric Tons of Carbon Dioxide Equivalents (MTeCO2)

Colgate's GHG emissions are measured in the international recognized units of metric tons of carbon dioxide equivalents (represented as MTeCO2). International protocol designates carbon dioxide as the standard by which other gases are measured for two specific reasons: 1) in order to provide a standard unit of measurement across the board and 2) carbon dioxide is the most abundant anthropogenic greenhouse gas.

Emissions Factors

Emissions factors are the key to calculating Colgate's greenhouse gas inventory. They measure the average rate of emission of each greenhouse gas from a particular source converted to carbon dioxide equivalents (MTeCO2). Certain activities–whether it is consuming oil for space heating or using gasoline for transportation–release different greenhouse gases into the atmosphere at different rates. Fuel oil #6, for example, releases three greenhouses into the atmosphere: carbon dioxide, methane, and nitrous oxide. The rate of emission for each of these greenhouse gases is 11.24 kg of CO2, 0.0395 kg of CH4, and 0.02831 kg of N2O for every gallon of fuel oil #6 consumed. The mission factor for fuel oil #6 is 0.01130 MTeCO2/gallon determined by multiplying the global warming potential for each greenhouse gas by its rate of emission and adding each together (Figure 1).

Figure 1. *Determining the emission factor for each source of greenhouse gas emissions using fuel oil #6 as an example.*

	Greenhouse Gas #1		*Greenhouse Gas #2*		*Greenhouse Gas #3*
Emission Factor =	(Global Warming Potential) X (Rate of Emissions)	+	(Global Warming Potential) X (Rate of Emissions)	+	(Global Warming Potential) X (Rate of Emissions)
	Carbon Dioxide (CO2)		Methane (CH4)		Nitrous Oxide (N2O)
Fuel Oil #6 =	1 x 11.24 kg/gallon	+	25 x 0.00158 kg/gallon	+	298 x 0.000095 kg/gallon
	Carbon Dioxide (CO2)		Methane (CH4)		Nitrous Oxide (N2O)
Fuel Oil #6 =	11.24 kg/gallon	+	0.0395 kg/gallon	+	0.02831 kg/gallon

Table 2. *Emissions Factors used to quantify Colgate's 2013 greenhouse gas emissions* [10]

Colgate Activity	Emission Factor
Scope 1	
Fuel Oil #6 (Gallons)	0.011302986
Fuel Oil #2 (Gallons)	0.010319827
Propane (Gallons)	0.005227719
Biomass (Wood Chips)	1.442541467
Gasoline Vehicles (Gallons)	0.008864802
Diesel Vehicles (Gallons)	0.010257085
Refrigerant (HFC-134a)	0.648637089
Refrigerant (HCFC-22)	0.82100219
Fertilizer (Organic)	0.00414123
Scope 2	
Electricity (kWh)	5.97E-05
Scope 3	
Faculty/Staff Commuting (Miles)	0.366766239
Faculty/Staff Commuting (Gallons)	0.008648022
Colgate Cruisers (Miles)	0.00032406
Colgate Cruisers (Gallons)	0.010570853
Outsourced Bus Travel (Miles)	0.000321218
Outsourced Bus Travel (Gallons)	0.010347846
Air Travel (Miles)	0.000526717
Landfill Waste (no CH4 recovery)	3.1
Landfill Waste (w/ CH4 recovery)	-0.03
Non-Recycled Paper (lbs)	0.001365993
30% Recycled Paper (lbs)	0.001216988
50% Recycled Paper (lbs)	0.001067983
100% Recycled Paper (lbs)	0.000769973
Dairy Cows on Leased Land	5.572619048

[10] Wood chips are not a part of Scope 1 emissions because, according to established protocols, wood chip combustion does not add any additional carbon to the carbon cycle

DATA COLLECTION

Annual Reporting

Data collection is the most time consuming part of Colgate's Greenhouse Gas Inventory. Going forward, we recommend that the data collection process commences in August of each year, giving employees the necessary time to finish their end of the fiscal year reporting before the students return for the new academic year.

The annual data collection process has started to become routine, and therefore, much easier if we are consistent in the timing and type of data we request when reaching out to individuals at Colgate. Nevertheless, because of busy schedules and data that are not easily available, Colgate staff members will need time to meet your request. Allow a few weeks for employees to get you the data you are requesting and anticipate that you may have to make multiple requests for the same data.

Once the appropriate data is collected, it should be entered into the *"Colgate Carbon Inventory Workbook"* created by Sustainability Office Intern, Andrew Pettit '11. The Workbook contains data entry fields and performs most of the necessary calculations through the built-in formulas. The Workbook can be obtained through the Administrative Fileshare or by contacting Colgate's Director of Sustainability (John Pumilio).

Overall, we recommend that Colgate's annual greenhouse gas inventory is completed by the target date of **December 15** of each year. This allows enough time for the report to circulate internally before publishing online to the ACUPCC Reporting System[11] by our annual deadline of January 15.

Institutional Data

Tracking institutional data is useful because it establishes a frame of historical reference and facilitates the comparison of Colgate's level of emissions in relation to other colleges and universities. Furtherm ore, significant changes in budget allocations, population, or square-footage of the built environment can have a great influence over the university's activities and energy consumption, and therefore, greenhouse gas emissions. Table 3 provides an overview of Colgate's institutional data for Fiscal Years 2009-2013.

Table 3. *Colgate's institutional data for fiscal Years 2009 through 2013.*

Fiscal Year	Budget (dollars)			Population			Physical Size (square-feet)
	Operating Budget	Research Budget	Energy Budget	Full-Time Students	Faculty	Staff	Total Building Space
2009	$147,320,539	$614,403	$4,712,740	2,784	280	688	2,331,239
2010	$149,220,020	$300,220	$3,950,587	2,770	278	678	2,331,239
2011	$148,433,361	$592,076	$4,310,783	2,876	280	659	2,305,648
2012	$152,207,713	$630,286	$4,585,035	2,934	293	663	2,340,773
2013	$157,766,968	$686,572	$4,819,008	2,927	318	648	2,310,726

[11] ACUPCC Online Reporting System can be accessed online at http://rs.acupcc.org/

Budget Information

Data Requested: The operation, research, and energy budgets for FY 2013.

Key Contact(s): Budget Reporting Analyst (Roy Langworthy) or Associate Vice President for Budget and Financial Aid (John Collins)

Population Information

Data Requested: The number of full-time students, faculty members, and staff members for FY 2013.

Key Contact(s): Director of Institutional Planning and Research for student enrollment (Brendt Simpson) and Human Resources for faculty/staff employment (Jill Dinski)

Physical Size

Data Requested: The university's total building space in square-feet for FY 2013.

Key Contact(s): Associate Vice President for Budget and Financial Aid (John Collins)

Energy and Water Costs

Tracking energy and water costs is valuable because it establishes a frame of historical reference and allows us to perform useful climate action planning analyses. Moreover, relatively small changes in our energy and water costs per unit can have big impacts on our operating budget. For these reasons, it is necessary to track energy and water costs as part of our inventory data collection process (Table 4).

Table 4. *Colgate's energy and water cost per unit, FY 2009 through FY 2013*

ENERGY AND WATER COSTS							
Fiscal Year	Wood Chips ($/ton)	Fuel Oil #6 ($/gallon)	Fuel Oil #2 ($/gallon)	Kerosene ($/gallon)	Propane ($/gallon)	Electricity ($/kWh)	Water ($/1,000 gallons)
2009	$40.00	$2.24	$3.50	-	$2.15	$0.043	$8.26
2010	$40.00	$1.39	$2.30	-	$1.45	$0.042	$9.12
2011	$42.00	$2.01	$2.29	$2.53	$1.52	$0.045	$9.28
2012	$44.00	$2.18	$2.91	$3.87	$1.95	$0.041	$9.68
2013	$41.88	$2.53	$2.96	$2.53	$1.59	$0.041	$9.18

Fuel Oil #6, Fuel Oil #2, Kerosene, and Propane (cost per gallon)

Data Requested: Cost per gallon of fuel oil #6, fuel oil #2, kerosene, and propane for FY 2013.

Key Contacts: Director of Purchasing can provide the contractual pricing for all fuels.

Wood Chips (cost per ton)

Data Requested: Cost per ton of wood chips for FY 2013.

Key Contact(s): Associate Director of Facilities and Manager of Engineering Services (Dan McCoach).

Electricity (cost per kWh) and Water (cost per 1,000 gallons)

Data Requested: Cost per kilowatt-hour (kWh) of electricity and cost of 1,000 gallons of water for FY 2013.

Key Contact(s): Manually calculate from monthly bill. John Pumilio has access.

Data Received: Summary of monthly billing statements with total usage and cost for both electricity and water.

Calculations: To calculate the cost of electricity per kWh and water per 1,000 gallons, we divided the total annual cost by the total annual usage. For electricity, the total cost includes:

- *Normal Rate Charge*: The Village of Hamilton uses primarily hydropower, which is obtained from Niagara Falls. The Village is allotted a designated amount of hydropower each month to be used by its customers (including Colgate). The rate is set by the Village and does not fluctuate from month to month unless a rate change is approved by the utilities commission.
- *Purchased power adjustment (PPA)*: When the Village exhausts its hydropower allotment, they are forced to purchase "extra" electricity from the grid. These purchases are made at a different (and often higher) rate than our normal electricity rate.
- *Demand charge*: Demand charges cover start up and equipment costs when electricity is needed intermittently (often during peak times). Demand charges are based on maximum demand, which is the greatest usage of electricity that occurred over a period, usually a month. Once established, the rate remains in effect for eleven months, or until a new maximum is established. To minimize demand charges, electricity usage should be spread out over a period to reduce the peak demand that may occur during any given time frame.

For water, total cost includes normal rate charge plus sewer costs. The Village bills Colgate in units of 100 cubic feet. Therefore, we need to convert cubic feet to gallons (one cubit foot equals 7.48 gallons) to get cost per 1,000 gallons.

Biogenic Emissions (Wood Chips)

In 1981, Colgate University began using wood chips as the primary source of energy for space heating and domestic hot water. Although the wood firing capacity of Colgate's biomass plant is only about 40 percent of the peak cold day campus steam requirement, that capacity is used year-round at nearly full load so that Colgate derives 75 to 80 percent of our annual heating requirement from wood combustion.

Burning wood chips for energy releases stored carbon into the atmosphere. However, according to international protocol specified in the GHG Protocol guidelines, this carbon does not add to Colgate's greenhouse gas footprint or contribute to anthropogenic climate change. Carbon released from combusting wood chips is on the natural and short carbon cycle and would eventually cycle back to the atmosphere through death and decomposition. In other words, the carbon that is released from Colgate's biomass plant was removed quite recently from the atmosphere through photosynthesis as the tree grew. Therefore, burning wood for energy will not increase the total amount of carbon in the carbon cycle if the source of biomass comes from sustainable forestry practices.

Clean Air-Cool Planet guidelines suggest that we track emissions associated with Colgate's biomass plant, but report them separately from the rest of our emissions (Table 5).

Wood Chips

Data Requested: Tons of wood chips for FY 2013.

Key Contact(s): The data can be found in the Buildings and Grounds fileshare (Wood and Fuel Reports). This report can be retrieved with the assistance of the Office Manager of the Facilities Department (Amy Davidson) or the Associate Director of Facilities and Manager of Engineering Services (Dan McCoach).

Table 5. *Colgate's emissions associated with wood chip combustion, FY 2007 through FY 2013.*

Fiscal Year	Wood Chips	Emission Factor	GHG Emissions
	(tons)	(MTeCO2/ton)	(MTeCO2)
2007	19,158	0.155462469	2,978
2008	19,714	0.155462469	3,065
2009	22,249	0.155462469	3,459
2010	23,898	0.155462469	3,715
2011	23,058	0.155462469	3,585
2012	21,718	0.155462469	3,376
2013	23,294	0.155462469	3,621

Scope 1 Emissions

Scope 1 emissions are direct emissions from sources that are owned and/or controlled by Colgate University. This includes combustion of fossil fuels in university-owned facilities or vehicles, fugitive emissions from refrigerant chemicals, and emissions associated with grounds maintenance.

On-Campus Stationary Combustion of Fossil Fuels

Colgate University sues four types of fossil fuels to provide heat and hot water to campus buildings: fuel oil #6, fuel oil #2, kerosene, and propane (Table 6).

Colgate's central steam plant heats 37 main campus buildings and provides the heat source for laundry equipment, domestic water heating, dining hall food preparation, laboratory, library, ice rink humidity control, and building humidification. While Colgate's primary source of steam production comes from the campus 900 boiler horsepower (BoHP) wood chip boiler, we use fuel oil #6 as our secondary fuel in the central steam plant. Fuel oil #2 is used as the primary heating fuel for 486,700 gross square-feet of facilities that do not have access to steam from the Central Plant. This includes Colgate's buildings on Broad Street (e.g., fraternity and sorority houses, Sanford Field House, and others). Kerosene provides heat energy to a few buildings including 80 Broad Street, Seven Oaks Club House and Repair Shop, Schupf Art Studio, and the Student Health Center. And, finally, propane is used for fireplaces, heating, cooking, and hot water in a few buildings including a number of buildings on Broad Street, the Coop, Parker Commons, the Heating Plant, Frank Dining Hall, Bryan Dining Hall, Base Camp, Merrill House, Trap Range, 13 East Kendrick, Central Receiving, Watson House, Olin Hall, Wynn Hall, and 100 Hamilton Street.

Table 6. *Greenhouse gas emissions from on-campus stationary source, FY 2009 through FY 2013.*

On-Campus Stationary Combustion of Fossil Fuels				
Fiscal Year	Fuel Type	Consumption (gallons)	Emission Factor (MTeCO2/gallon)	GHG Emissions (MTeCO2)
2009	Fuel Oil #6	371,457	0.011757907	4,368
	Fuel Oil #2	185,503	0.01004635	1,864
	Kerosene	-	-	-
	Propane	-	-	-
2010	Fuel Oil #6	283,974	0.011757907	3,339
	Fuel Oil #2	174,399	0.01004635	1,752
	Kerosene	4,604	0.01004635	46
	Propane	-	-	-
2011	Fuel Oil #6	293,425	0.011761262	3,451
	Fuel Oil #2	189,944	0.010049435	1,909
	Kerosene	8,212	0.010049435	83
	Propane	32,569	0.005440764	177
2012	Fuel Oil #6	215,397	0.011302986	2,435
	Fuel Oil #2	167,539	0.010319827	1,729
	Kerosene	8,085	0.010319827	83
	Propane	31,329	0.005266042	165
2013	Fuel Oil #6	264,643	0.011302986	2,991
	Fuel Oil #2	182,090	0.010319827	1,879
	Kerosene	7,102	0.010319827	73
	Propane	30,913	0.005227719	162

Fuel Oil #6

Data Requested: Gallons of fuel oil #6 consumed for FY 2013.

Key Contact(s): The data can be found in the Buildings and Grounds fileshare (Wood and Fuel Reports). This report can be retrieved with the assistance of the Office Manager of the Facilities Department (Amy Davidson) or the Associate Director of Facilities and Manager of Engineering Services (Dan McCoach). Director of Sustainability (John Pumilio) has access.

Fuel Oil #2

Data Requested: Gallons of fuel oil #2 for FY 2013.

Key Contact(s): The data can be found in the Buildings and Grounds fileshare. This report can be retrieved with the assistance of the Office Manager of the Facilities Department (Amy Davidson) or the Associate Director of Facilities and Manager of Engineering Services (Dan McCoach). Director of Sustainability (John Pumilio) has access.

Kerosene

Data Requested: Gallons of kerosene consumed for FY 2013.

Key Contact(s): Director of Purchasing can provide annual consumption from supplier billing.

Propane

Data Requested: Gallons of propane consumed for FY 2013.

Key Contact(s): Director of Purchasing can provide annual consumption from supplier billing.

Colgate Vehicle Fleet

Colgate University, like most colleges and universities, owns and maintains a fleet of vehicles. The decisions Colgate makes regarding the purchase and operation of this fleet has a direct impact on our institution's greenhouse gas emissions. Therefore, it is important to keep track of Colgate's fleet fuel use, as it is a direct contribution to global warming. The Colgate vehicle fleet consists of about 95 vehicles (22 student/faculty vans, 68 Buildings and Grounds vehicles, and 5 Campus Safety vehicles) and was responsible for 542 tons of greenhouse gas emissions in 2013, about 3.9 percent of Colgate's total emissions (Table 7).

Table 7. *Colgate's greenhouse gas emissions from university vehicle fleet, FY 2013.*

B&G Gasoline Pump	Golf Course Gasoline Pump	B&G Vehicles Fueled Off-Campus	Campus Safety Vehicles	Total Gasoline	Emission Factor	GHG Emissions
(gallons)	(gallons)	(gallons)	(gallons)	(gallons)	(MTeCO2/ gallon)	(MTeCO2)
35,024.0	5,226.0	3,447.7	1,485.3	45,183	0.008864802	401

B&G Diesel Pump	Golf Course Diesel Pump	Total Diesel	Emission Factor	GHG Emissions
(gallons)	(gallons)	(gallons)	(MTeCO2/gallon)	(MTeCO2)
9,210	4,555	13,765	0.010257085	141

Capturing fuel consumption for Colgate's vehicle fleet comes from four sources:

1. Building and Grounds gasoline and diesel pumps
2. Seven Oaks golf course gasoline and diesel pumps
3. Buildings and Grounds vehicles fueled off-campus after hours
4. Campus Safety vehicles fueled off-campus after hours

Buildings and Grounds Gasoline and Diesel Pumps

Data Requested: Gallons of gasoline and diesel consumed for FY 2013.

Key Contact(s): Director of Purchasing can provide annual consumption from supplier billing.

Seven Oaks Golf Course Gasoline and Diesel Pumps

Data Requested: Gallons of gasoline and diesel consumed for FY 2013.

Key Contact(s): Director of Purchasing can provide annual consumption from supplier billing.

Buildings and Grounds Vehicles Fueled Off-Campus

Data Requested: Gallons of gasoline consumed for FY 2013.

Key Contact(s): Buildings and Grounds Administrative Assistant (Amy Davidson) tracks vehicle fleet gasoline reimbursements throughout the year and can provide total consumption.

Campus Safety Vehicles Fueled Off-Campus

Data Requested: Gallons of gasoline consumed in FY 2013.

Key Contact(s): Campus Safety Administrative Assistant (Sue Marks) tracks Campus Safety gasoline use throughout the year and can provide total gasoline consumption.

Refrigerants (HFC-314a and HCFC-22)

Colgate University has an on-campus chiller for space cooling, water fountains, and refrigerators across campus that use HFC-134a refrigerant. Additionally, Starr Hockey Rink and the Dana Arts Center use HCFC-22. These refrigerant hydrocarbons meet all the required standards specified by the U.S. EPA in order to reduce the rate of ozone depletion. Unfortunately, hydrocarbons are powerful greenhouse gases. HFC-134a, for example, has a global warming potential of 1,430 (meaning that it is 1,430 times more potent as a greenhouse gas than carbon dioxide). Therefore, it is important to calculate the amount of refrigerant chemicals Colgate uses on an annual basis. In 2011, refrigerants accounted for more than 592 tons of GHG emissions, but that number has fallen dramatically in recent years. (Table 8).

Table 8. *Greenhouse gas emissions from HFC-134a and HCFC-22 refrigerant chemical use, FY 2011-2013.*

Refrigerant Chemicals							
Fiscal Year	HFC-134a Refrigerant Loss	Emission Factor	GHG Emissions	HCFC-22 Refrigerant Loss	Emission Factor	GHG Emissions	Total GHG Emissions
	(lbs)	(MTeCO2/lb)	(MTeCO2)	(lbs)	(MTeCO2/lb)	(MTeCO2)	(MTeCO2)
2011	108	0.589670081	64	685	0.77110703	528	592
2012	46	0.648637089	30	543	0.77110703	419	449
2013	1	0.648637089	1	281	0.82100219	231	231

HFC-134a

Data Requested: The total usage (in pounds) of the refrigerant type for HFC-134a for FY 2013.

Key Contact(s): Physical Plant Foreperson (Brian Belden).

HCFC-22

Data Requested: The total usage (in pounds) of the refrigerant type HCFC-22 for FY 2013.

Key Contact(s): Physical Plant Foreperson (Brian Belden).

Fertilizer Application (Organic)

Fertilizer used for campus landscaping and on the golf course release nitrous oxides into the atmosphere due to its nitrogen content. Even though nitrous oxide is 298 times more powerful as a global warming agent than carbon dioxide, Colgate's emissions from fertilizer use is relatively small (Table 9). Nevertheless, they do contribute to global warming and our annual use of fertilizer is relatively easy to track.

Table 9. *Greenhouse gas emissions from fertilizer application, FY 2009 through FY 2013.*

Fertilizer Application (Organic)					
Fiscal Year	Landscaping	Golf Course	Total Fertilizers	Emission Factor	GHG Emissions
	(lbs of nitrogen)	(lbs of nitrogen)	(lbs)	(MTeCO2/lb)	MTeCO2
2009	10,080	1,059	11,139	0.00414123	46
2010	4,800	297	5,097	0.00414123	21
2011	5,600	275	5,875	0.00414123	24
2012	4,656	2,027	6,683	0.00414123	28
2013	2,925	173	3,098	0.00414123	13

Organic Fertilizer

Data Requested: The type and total amount (in pounds) and percent nitrogen of fertilizer used on campus grounds and on the golf course for FY 2013.

Key Contact(s): Grounds Manager (Mike Jasper), Golf Course Manager (Jon McConville), and the Supervisor of Athletics Grounds (Emmett House).

Comments: All fertilizers used on campus in FY 2013 were organic.

Calculations: The total amount of fertilizer (in pounds) must be multiplied by the percentage of nitrogen to get the total amount (in pounds) of nitrogen used. The amount of nitrogen used (in pounds) is then multiplied by the emissions factor to get tons of greenhouse gas emissions.

Scope 2 Emissions

Scope 2 emissions are the indirect emissions from sources that are neither owned nor operated by Colgate University, but whose products are directly linked to on-campus energy consumption. Scope 2 emissions include all emissions generated in the production of electricity consumed by the institution.

Purchased Electricity

In order to calculate Colgate's emissions associated with the purchase and use of electricity, we have to determine how our electricity is produced and calculate the rate of greenhouse gas emissions associated with each source. Colgate purchases electricity from the Village of Hamilton which operates as a municipal electric, water, and sewer utility. The vast majority (84 percent) of the Village's electricity is purchased directly from large-scale hydroelectric power mainly from Niagara Falls. The remaining electricity (16 percent) is purchased from the New York State grid and comes from a mix of sources including nuclear, wind, coal, and other fossil fuels. Colgate's emissions factor of 0.0000596931 MTeCO2/ kWh is significantly lower than the Upstate New York average of 0.000373082 MTeCO2 per kWh. This lower factor is based on the large amount of hydroelectric, nuclear, and wind power that makes up the Village's electricity mix. The result of this low emissions factor is that Colgate's overall emissions associated with electricity use is also relatively low making up around 10 percent of the university's total emissions (Table 10).

Data Requested: The total purchased electricity in FY 2013, in kWh.

Key Contact(s): The Associate Controller and Director of Financial Reporting (Dan Partigianoni) to provide the total purchased electricity, and the Village of Hamilton municipal electric utility (Sean Graham) to provide the source of purchased electricity.

Data Received: As of 2013, Colgate receives a monthly bill for each building from the Village. At the end of the fiscal year, Colgate's total annual electricity use is manually entered and added together for each building for each month.

Calculations: The Clean Air-Cool Planet Campus Carbon Calculator has a feature that can help you determine the emissions factor for your local electricity mix. Simply enter the percentages of your electricity sources into the custom fuel mix section of the calculator.

Table 10. *Greenhouse gas emissions from purchased electricity, FY 2008 through FY 2013.*

Purchased Electricity			
Fiscal Year	Total (kWh)	Emissions Factor (MTeCO2/kWh)	GHG Emissions (MTeCO2)
2008	30,783,478	5.97E-05	1,838
2009	31,571,030	5.97E-05	1,885
2010	30,264,128	5.97E-05	1,807
2011	30,883,211	5.97E-05	1,844
2012	30,390,822	5.97E-05	1,814
2013	30,252,750	5.97E-05	1,806

Scope 3 Emissions

Scope 3 emissions are all other indirect emissions attributed to our institution – those that are a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution. Colgate's Scope 3 emissions include faculty and staff commuting, bus commuting, employee business ground travel, air travel paid by or through the university, solid waste, and paper use. As explained earlier in this report, student commuting is considered de minimus emissions and not included in Colgate's greenhouse gas inventory.

Faculty and Staff Commuting

Most Colgate faculty and staff commute to work by driving. In order to calculate the emissions associated with this behavior, we need to determine the amount of gasoline consumed by each employee over the course of the year for commuting. We estimate this by conducting an annual survey (established in FY 2010) using Qualtrics and distributing to the campus community over email (Appendix A). For incentive to complete the survey, we offer prizes (e.g., movie tickets, bookstore gift card, tickets to an athletic game) for a few randomly selected individuals. The survey needs to capture how many days per week and weeks per year each individual drives to campus, the distance traveled, and the average miles per gallon of their vehicle.

2013 Annual Commuter Survey

Data Needed: Gallons of gasoline consumed through faculty and staff commuting in FY 2013.

Key Contact(s): Environmental Studies and Sustainability Program Assistant (Steve Dickinson) created the survey and administered the analysis. Administrative Coordinator, Dean of Faculty (Penny Mintel) emails the survey to the campus community via Campus Distributions.

Data Received: The 2013 Commuter Survey gave us an average of how many days per week and weeks per year each individual drove to campus, the distance traveled, and the average miles per gallon of their vehicle for the 348 individuals who completed the survey.

Calculations: Based on 345 responses, the average Colgate employee used 141 gallons of gasoline in FY 2013 to commute back and forth to work. Multiply 141 gallons by 966 employees equals 145,866 gallons in total for FY 2013. Multiply 145,866 gallons by the emissions factor for gasoline (0.008648022 MTeCO2 per gallon) equals 1,293 MTeCO2 (Table 11).

Comments: The Annual Commuter Survey should be distributed to the campus community via email in late September or early October to maintain consistency between years.

Table 11. *Greenhouse gas emissions from faculty and staff commuting, FY 2010 to FY 2013.*

Faculty and Staff Commuting			
Fiscal Year	Total Gasoline (gallons)	Emission Factor (MTeCO2/gallon)	GHG Emissions (MTeCO2)
2010	157,740	0.008924124	1,408
2011	153,057	0.008928806	1,367
2012	154,872	0.009097265	1,409
2013	145,866	0.008648022	1,261

Directly Financed Outsourced Bus Travel

Colgate University contracts through Birnie Bus Services, Inc. to provide free transportation service around campus and to select locations in the downtown area called the Colgate Cruiser. Birnie Bus also provides service to Colgate's athletic teams for competition away from home.

Bus Commuting (Colgate Cruiser)

Data Requested: Gallons of diesel consumed for each of the buses that make up the Colgate Cruiser bus service in FY 2013.

Key Contact(s): The Birnie Bus terminal in Hamilton, NY (315-824-1260) provides the Cruiser data upon request. Although data was not obtained until visiting the bus terminal and asking for the data in person.

Athletics Travel

Data Requested: Gallons of diesel consumed in FY 2013 for bus service for varsity athletic travel.

Key Contact(s): Administrative Assistant, Athletics (Lori Godshalk).

Data Received: Gallons of diesel consumed for FY 2013 for bus service for varsity athletic travel.

Comments: Sport club outings use the "T" vans that are owned by Colgate, and therefore, included within the 'Colgate Vehicle Fleet' data as Scope 1 emissions.

Table 12. *Greenhouse gas emissions from outsourced bus travel, FY 2009 through FY 2013.*

Directly Financed Outsourced Bus Travel							
Fiscal Year	Cruiser (gallons)	Diesel Emissions Factor (MTeCO2/gallon)	GHG Emissions (MTeCO2)	Athletics Travel (gallons)	Diesel Emissions Factor (MTeCO2/gallon)	GHG Emissions (MTeCO2)	Total Emissions (MTeCO2)
2009	7,230	0.0100761	73	18,335	0.0100761	185	258
2010	7,144	0.0100761	72	18,683	0.0100761	188	260
2011	11,985	0.010077767	121	17,352	0.010077767	175	296
2012	10,931	0.010347846	113	19,804	0.010347846	205	318
2013	10,234	0.010347846	106	16,512	0.010347846	171	277

Employee Business Ground Travel

Colgate faculty and staff sometimes drive their personal vehicles to conduct Colgate business. The emissions associated with this practice are Scope 3 emissions since they are shared by the university and the individual who decides on the purpose and mode of that travel. We began capturing this source of emissions in FY 2011 with the creation of accounting code -387. Employees who drive their own cars for business are reimbursed through accounting code -387. With the total annual reimbursement cost for -387, we can determine the amount of gasoline consumed (Table 13).

Accounting Code -387

Data Needed: Gallons of gasoline consumed by faculty and staff who drive their personal vehicles to conduct Colgate business in FY 2012.

Key Contact(s): To obtain the accounting code -387 data, contact the Associate Vice President/Controller of the Accounting Office (Tom O'Neill) and the Accounting Assistant (Leta Wiley).

Data Received: Total reimbursement cost for accounting code -387.

Calculations: The total cost of accounting code -387 was received from the Accounting Office at the FY 2012 federal reimbursement rate of $0.56 per mile. However, $0.22 per mile is awarded for the depreciation of the vehicle[12]. Therefore, we multiplied the total reimbursement cost for accounting code -387 by 60 percent to determine the amount of money spent on gasoline only (and not on vehicle depreciation). We then divided the total reimbursement cost for gasoline only by $3.49 (the national average cost per gallon of gasoline[13]) in order to determine the total gallons of gasoline consumed.

Table 13. *Greenhouse gas emissions from employee business ground travel, FY 2013.*

Employee Business Ground Travel							
Fiscal Year	Reimbursement Cost	Reimbursement for Gasoline	Total Reimbursement for Gasoline	Average Cost per Gallon of Gasoline	Total Gasoline Consumption	Emission Factor	GHG Emissions
	($)	(%)	($)	($)	(gallons)	(MTeCO2/ gallon)	(MTeCO2)
2011	$286,687	57%	$163,411.59	$3.05	53,578	0.008928806	478
2012	$339,941	60%	$203,964.60	$3.54	96,029	0.009097265	874
2013	$292,828	60%	$175,697.39	$3.49	83,905	0.008864802	744

[12] This information was retrieved from the IRS website in "Notice 2010-88." The weblink is http://www.irs.gov/newsroom/article/0,,id=232017,00.html.

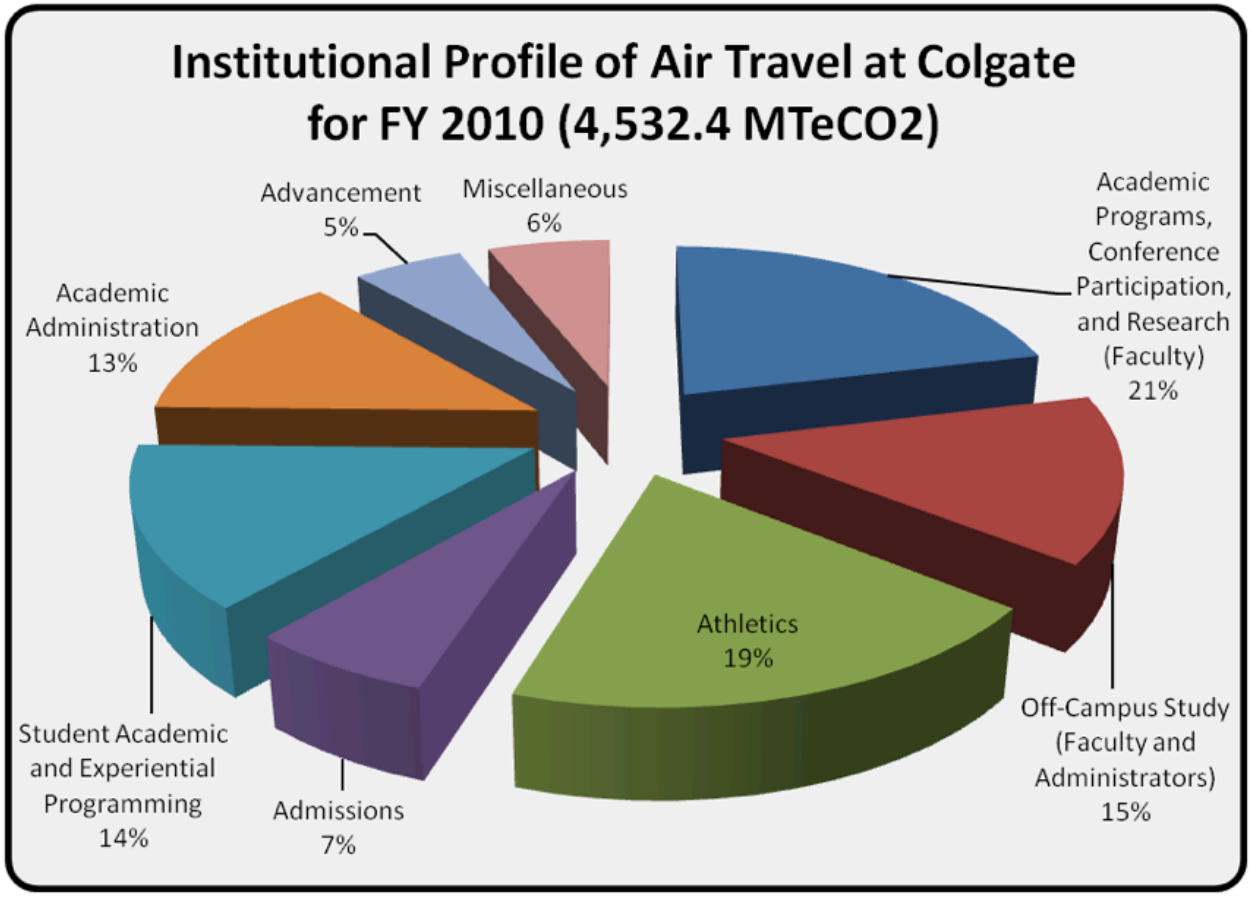
[13] To find the national average cost per gallon, we used the U.S. Energy Information Administration (U.S. EIA) website: http://www.eia.gov/petroleum/gasdiesel/. Download the "Full History" spreadsheet for U.S. regular gasoline prices. Then, we averaged the weekly data for the FY 2011.

Air Travel

Air travel plays a vital role in many university functions, a role that is arguably exacerbated by Colgate's rural location and our commitment to certain institutional priorities. Faculty travel by air to support research and conference participation, for example, and professional staff throughout the university require air travel to pursue their work. Colgate's commitment to robust off-campus study opportunities, as well as to Division I athletics, also underscores the centrality of air travel to the university's mission.

The Air Travel Subcommittee distinguished the amount of air travel by various institutional categories in FY 2010 (Figure 2). They did this both to capture a recent institutional profile of air travel at Colgate and to allow for tracking trends across the institution over time.

Figure 2. *Air travel emissions by various categories, FY 2010.*



All air travel paid by the university on the behalf of faculty, staff, students, and invited guests is being tracked through the new account code -386. By compiling -386 expenditures across the institution—including budget charges, direct reimbursements, and JPMorgan charges—and adding to this other air travel expenditures such as tickets purchased on behalf of athletic teams, we are now able to efficiently capture the vast majority of Colgate's required Scope III air travel emissions. For FY 2010, as for FY 2009 (our baseline greenhouse gas inventory), our accounting office was able to determine air travel expenditures across the institution through a more labor-intensive process that involved "manually" compiling these expenditures on air travel. With the total annual expenditures for air travel (accounting code -386), we can determine the amount of annual miles traveled and resulting emissions (Table 14). Colgate's Center for Outreach Volunteerism and Education (COVE) also sponsors alternative spring breaks and other volunteer programming requiring

air travel. As of FY 2013, COVE airfare is included in the -386 budget line and therefore no longer calculated separately from other air travel (Table 14).

Table 14. *Greenhouse gas emissions from air travel, FY 2009 through FY 2013.*

Air Travel						
Fiscal Year	Business	Athletics	COVE	Total	Emission Factor	GHG Emissions
	(miles)	(miles)	(miles)	(miles)	(MTeCO2/mile)	(MTeCO2)
2009	5,960,140	19,461	5,966	5,985,567	0.000776336	4,647
2010	5,838,481	525,790	63,746	6,428,017	0.000776336	4,990
2011	6,328,300	-	246,393	6,574,693	0.000776369	5,104
2012	6,914,119	-	91,331	7,005,450	0.000546154	3,826
2013	6,988,076	-	-	6,988,076	0.000526717	3,681

Accounting Code -386

Data Requested: Annual air travel paid for by or through the university to conduct Colgate business in FY 2013 in miles.
Key Contact(s): Staff Accountant (Leta Wiley).
Data Received: Total FY 2013 air travel expenditures for accounting code -386.
Calculations: According to accounting code -386, the total money spent on faculty and staff air travel in FY 2013 was $1,366,230. From the total cost, we calculated mileage using the method recommended by the Association for the Advancement of Sustainability in Higher Education (AASHE). This method requires taking the average cost per mile for air travel as provided by the Air Transport Association of America[14], increasing that average by 20 percent to account for taxes, and then dividing the total cost of air travel by the resulting amount. This equation is:

- Average cost per mile YTD 2012 = 15.51 cents per mile. Plus taxes equals (16.47 + (16.47 x .20)) = 19.76 cents per mile = 6,988,076 miles.
- 6,988,076 miles X 0.000526717 MTeCO2/mile = 3681 metric tons of greenhouse gas emissions (MTeCO2).

Comments: Accounting code -386 captures the vast majority of Colgate's overall business-related air travel and air travel from our athletic teams. Accounting code -386 does not capture most study abroad travel as students pay for their tickets and is not captured in our accounting systems. Also, flights paid through “funds” (as opposed to “orgs”) are also not included in -386. For example, if a faculty member receives a research grant from the National Science Foundation (NSF) and travels with that money, then it is not included in our calculations as it becomes prohibitive to go through every fund number and root out air travel for the year. As a result, study abroad travel and travel for research paid for by grants are not included in Colgate's annual greenhouse gas inventory.

Landfill Waste

Colgate University owns two vehicles that transfer our solid waste to the Madison County Landfill and Recycling Center in the Town of Lincoln approximately 20 miles from campus. One truck transports recyclables (paper, paper products, metals, plastics, and glass) and the other transports landfill waste. For the purposes of Colgate’s greenhouse gas inventory, we are only concerned about the amount of landfill waste (and not recycled waste) because landfill waste emits

[14] This information was accessed online in December 2012 from the Air Transport Association of America website at: http://www.airlines.org/Pages/ATA-Monthly-Passenger-Yield-%28Fares-per-Mile%29.aspx (Also accessed through a Google search for “price per passenger air mile”).

a potent greenhouse gas (methane) as it decomposes. However, different landfills have different techniques for how they handle methane emissions and these different techniques result in very different levels of greenhouse gas emissions. Therefore, it is necessary to know how the Madison County Landfill handles its methane emissions in order to determine the emission factor for Colgate's landfill waste.

In FY 2010, the Madison County Landfill installed a methane capture and electric generation system that has much lower greenhouse gas emissions per ton:

- Prior to FY 2010 (no methane recovery): emissions factor = 1.0842857 MTeCO2/short ton
- FY 2010 and beyond (methane recovery and electric generation): emissions factor = -0.03 MTeCO2/short ton.

As a result, Colgate's overall emissions associated with our landfill waste were significantly reduced (Table 15).

Further emission reductions occurred because Colgate reduced its landfill waste per full-time equivalent student (FTE) through:

- improved recycling of paper and bottles and cans;
- a new electronic waste recycling program;
- a new composting program;
- decreased overall paper consumption by over four million sheets of paper; and
- increased use of reusable containers (instead of one-time use disposable containers).

Data Requested: Total annual landfill waste in short tons for FY 2013.
Key Contact(s): Monthly billing statements from Madison County Landfill with Colgate's tons of landfill obtained from accounting. Director of Sustainability (John Pumilio) has copies.
Calculations: Add the monthly reports to get the annual total.

Table 15. *Colgate's greenhouse gas emissions associated with landfill waste, FY 2008 through FY 2013.*

Landfill Waste					
Fiscal Year	Landfill Waste	Emission Factor	GHG Emissions	Full-time Equivalent Students	GHG Emissions per FTE
	(short tons)	(MTeCO2/mile)	(MTeCO2)	(FTEs)	(MTeCO2)
2008	928.82	1.0842857	1007	2,767	0.36
2009	812.61	1.0842857	881	2,784	0.32
2010	778.44	0.1606349	125	2,770	0.05
2011	793.81	0.1746032	139	2,876	0.05
2012	754.14	-0.03	-23	2,934	-0.01
2013	738.97	-0.03	-22	2,927	-0.01

Paper Consumption

Colgate University's paper consumption is tracked through two main sources: 1) departmental purchasing and 2) the Print Shop. We track the amount of paper consumed by its recycled content (e.g., non-recycled, 30 percent, 50 percent, and 100 percent), because the greater the recycled content, the lower the rate of emissions (Table 16) and the more environmentally benign.

Table 16. *Colgate's greenhouse gas emissions associated with paper consumption, FY 2010 through FY 2013.*

Paper Consumption						
Fiscal Year	Paper Type	Departmental Consumption	Print Shop Consumption	Total Consumption	Emission Factor	GHG Emissions
	(% recycled)	(lbs)	(lbs)	(lbs)	(MTeCO2/lb)	(MTeCO2)
2010	0%	21,613	19,888	41,501	0.0012905	54
	30%	42,157	9,270	51,427	0.001147067	59
	50%	1,825	14,664	16,489	0.001051445	17
	100%	21,482	950	22,432	0.00081239	18
	TOTAL	87,077	44,772	131,849	-	148
2011	0%	15,616	19,517	35,133	0.0012905	45
	30%	44,961	3,399	48,360	0.001170973	57
	50%	7,929	15,381	23,310	0.001051445	25
	100%	21,329	1,481	22,810	0.00081239	19
	TOTAL	89,835	39,778	129,613	-	145
2012	tree-free	4,056	0	4,056	0	0
	0%	0	30,793	30,793	0.001365993	42
	30%	35,820	17,495	53,315	0.001216988	65
	50%	6,931	7,620	14,551	0.001067983	16
	100%	27,464	1,810	29,274	0.000769973	23
	TOTAL	74,271	57,718	131,989	-	145
2013	tree-free		0	0	0	0
	0%	0	25,589	25,589	0.001365993	35
	30%	37,690	4,616	42,306	0.001216988	51
	50%	110	6,808	6,918	0.001067983	7
	100%	40,795	1,319	42,114	0.000769973	32
	TOTAL	78,595	38,332	116,927	-	126

Departmental Purchasing

The various departments and offices throughout campus individually order their paper through either Office Max or Staples. Since 2009, the amount of greenhouse gas emissions and overall purchase of paper from Office Max and Staples and the amount of paper used per student has been significantly reduced (Tables 17 and 18). This was accomplished by adding print-release stations in public printing areas, by setting double-sided printing as the default on campus machines in common areas, by widening margins, and through increased awareness and more conscious printing. In 2012 we introduced tree-free sugar cane paper to campus. This paper is purchased through a student owned business called Eco-Campus LLC, which grew out of a 2011 Thought into Action project. The sugar cane paper is made from a byproduct of the sugar industry and thus the use of this resource does not generate any new emissions. Table 18 also highlights the overall reduction in the purchase and use of non-recycled (virgin) paper on campus since 2009. FY 2012 was the first year in which purchasing non-recycled paper was not an option for departments.

Data Requested: The total amount of paper purchased in pounds through departmental purchasing by recycled content for FY 2013.
Key Contact(s): Director of Purchasing
Comments: The Office of Sustainability and Purchasing department eliminated the option to purchase non-recycled paper in FY 2013.
Calculations: To convert pounds of paper to sheets divide pounds by 5.05 (average weight of one package) and multiple by 500 (sheets per package).

Table 17. *Colgate departmental purchasing (sheets of paper consumed), FY 2009 through FY 2013.*

Departmental Paper Consumption								
Fiscal Year	Tree-free	0% recycled	30% recycled	50% recycled	100% recycled	TOTAL	Full-time equivalent students	TOTAL
	(sheets)	(sheets)	(sheets)	(sheets)	(sheets)	(sheets)	(FTEs)	(sheets/ FTE)
2009	-	4,576,040	3,177,624	5,248	5,118,713	12,877,625	2,784	4,626
2010	-	2,139,901	4,173,960	180,693	2,126,931	8,621,485	2,770	3,112
2011	-	1,546,099	4,451,560	785,097	2,111,831	8,894,587	2,876	3,093
2012	401,584	0	3,546,535	686,238	2,719,280	7,353,637	2,934	2,506
2013		0	3,731,683	10,891	4,039,109	7,781,683	2,927	2,659

Print Shop

The amount of greenhouse gas emissions and overall paper consumed through Colgate's Print Shop has also been reduced since we started tracking this data in FY 2010 (Tables 17 and 19).
Data Requested: The total amount of paper purchased in pounds through departmental purchasing by recycled content for FY 2013.
Key Contact(s): Director of Document and Mail Services (Bob Keats).
Calculations: To convert pounds of paper to sheets divide pounds by 5.05 (average weight of one package) and multiple by 500 (sheets per package).

Table 18. *Colgate Print Shop (sheets of paper consumed), FY 2010 through FY 2013*

Print Shop Paper Consumption							
Fiscal Year	0% recycled	30% recycled	50% recycled	100% recycled	TOTAL	Full-time equivalent students	TOTAL
	(sheets)	(sheets)	(sheets)	(sheets)	(sheets)	(FTEs)	(sheets/FTE)
2010	1,969,109	917,822	1,451,881	94,059	4,432,871	2,770	1,600
2011	1,932,376	336,535	1,522,871	146,634	3,938,416	2,876	1,369
2012	3,048,812	1,732,178	754,455	179,208	5,714,653	2,934	1,948
2013	2,533,564	457,030	674,059	130,594	3,795,248	2,927	1,297

COLGATE'S GROSS GREENHOUSE GAS EMISSIONS

Colgate's greenhouse gas footprint was 17,353 MTeCO2 (6.23 tons / FTE[15]) in 2009, 14,505 MTeCO2 (5.24 tons / FTE) in 2010, 16,194 MTeCO2 (5.63 tons / FTE) in 2011, 13,817 MTeCO2 (4.71 tons/FTE) in 2012, and 13,841 MTeCO2 (4.73 tons/FTE) (Table 19). This includes all Scope 1 emissions (on-site stationary combustion of fossil fuels, vehicle fleet emissions, fugitive refrigerant chemicals, and emissions associated with grounds maintenance) and Scope 2 emissions (purchased electricity). Colgate calculated sources of Scope 3 emissions consistent with the ACUPCC guidelines. Scope 3 emissions include faculty and staff commuting, bus travel, employee business ground travel, air travel paid for by or through the university, landfill waste, and paper consumption.

Since 2009, Colgate has reduced its overall emissions by about 20 percent and emissions per student (FTE) by about 25 percent. This reduction is the result of a number of new practices, policies, and resource conservation and efficiency measures that have been put into place since 2009 that are further detailed in Colgate's 2011 Sustainability and Climate Action Plan[16].

Table 19. *Colgate's gross greenhouse emissions by source and scope for FY 2009 through FY 2013.*

Fiscal Year	2009	2010	2011	2012	2013
Source of Emissions	Tons of Emissions				
SCOPE 1					
Fuel Oil #6	4,368	3,339	3,451	2,435	3,112
Fuel Oil #2	1,864	1,752	1,909	1,729	1,879
Kerosene	-	46	83	83	73
Propane	-	-	177	165	162
Vehicle Fleet	393	524	587	565	542
Refrigerants (HFC-134a and HCFC-22)	1,247	84	592	449	183
Fertilizer	46	21	24	28	13
SCOPE 1 TOTAL	7,918	5,766	6,823	5,454	5,964
SCOPE 2					
Purchased Electricity	1,885	1,807	1,844	1,814	1,806
SCOPE 2 TOTAL	1,885	1,807	1,844	1,814	1,806
SCOPE 3					
Faculty/Staff Commuting	1,626	1,408	1,367	1,409	1,293
Bus Travel (Cruisers and Athletics)	258	260	296	318	279
Employee Business Ground Travel	-	-	478	874	744
Air Travel	4,647	4,990	5,104	3,826	3,681
Landfill Waste	881	125	139	-23	-22
Paper Consumption	139	148	145	145	49
SCOPE 3 TOTAL	7,551	6,931	7,529	6,549	6,024
FTE	2,784	2,770	2,876	2,934	2,927
Tons/FTE	6.23	5.24	5.63	4.71	4.73
Gross Emissions	17,354	14,504	16,196	13,817	13,841

[15] FTE = Full-time equivalent student.

[16] Website: https://sites.google.com/a/colgate.edu/2011-2015-sustainability-and-climate-action-plan/

For each of the four years we have completed Colgate's greenhouse gas footprint, the stationary combustion of fossil fuels for space heating and domestic hot water remains the largest single source of emissions (Figure 3). Colgate consumes fuel oil #6, as the existing wood boiler does not have enough capacity to provide heat to all buildings connected on the steam line during the winter months. Colgate also burns fuel oil #2 in buildings not connected to the steam line. Air travel emissions are a close second. Combined, stationary combustion of fossil fuels on campus and air travel comprise nearly two-thirds of Colgate's total greenhouse gas emissions (Figure 4). The drop in landfill waste emissions since 2009 can be attributed to both a reduction in overall landfill waste due to better recycling and composting and a switch to a methane capture and electricity generation at the Madison County Landfill. This switch significantly reduced the rate of emissions associated with Colgate's landfill waste production.

Figure 3. *Total emissions by source, FY 2009 through FY 2013.*

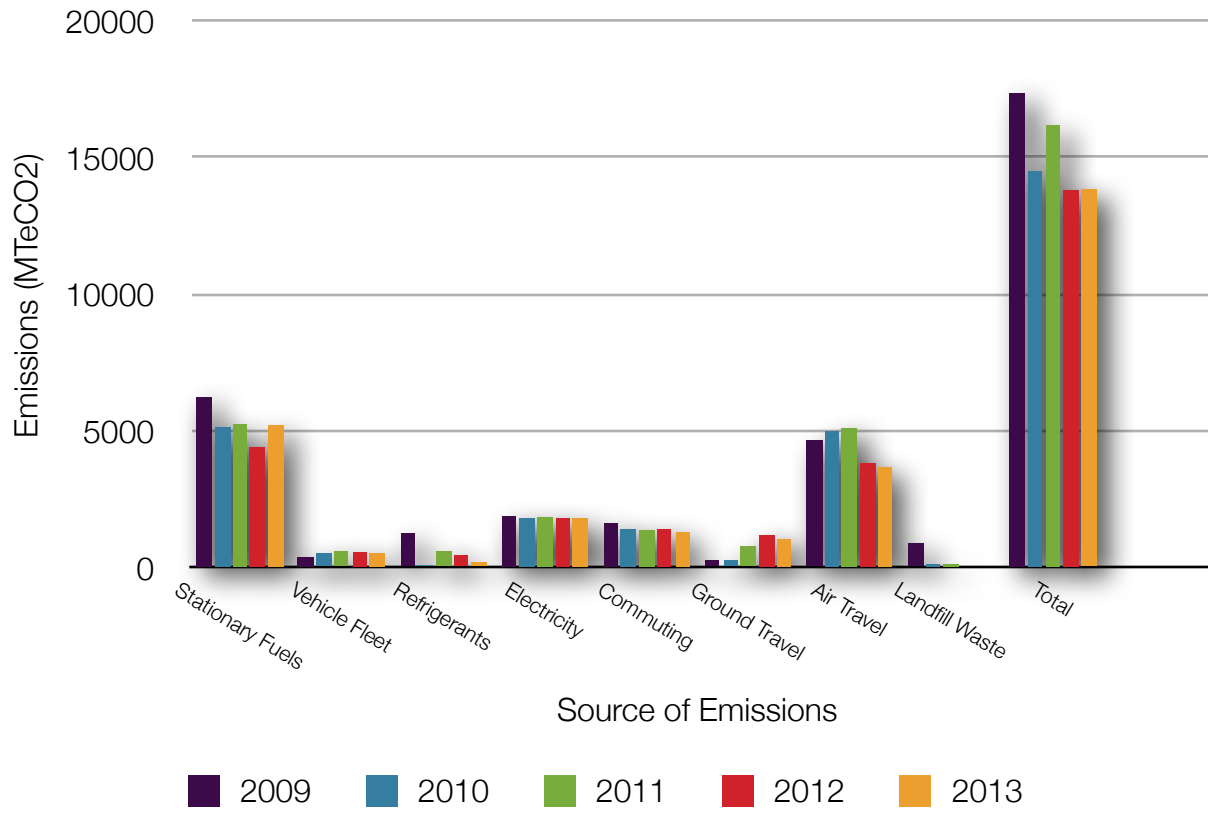
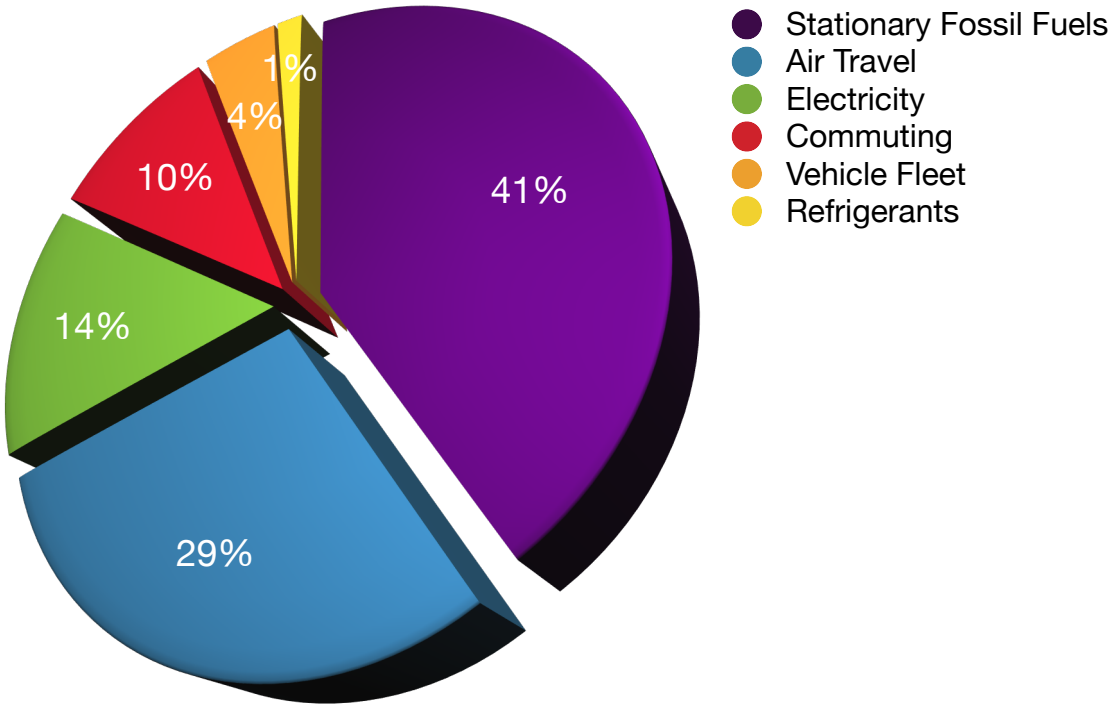


Figure 4. FY 2013 percentage of gross emissions by source.



CARBON OFFSETS AND NET GREENHOUSE GAS EMISSIONS

Thus far we have examined Colgate's activities that add greenhouse gases into the atmosphere. However, we also need to consider activities that sequester and/or avoid emitting greenhouse gases in order to determine our net carbon budget. In FY 2013, Colgate's source of offsets included the annual rate of carbon sequestration of our purchased offsets in Patagonia Sur as well as other purchased offsets described below. As a result, Colgate's net greenhouse gas emissions in FY 2013 is 5,570 MTeCO2 (Table 21).

Forest Preservation

In FY 2013, Colgate completed a detailed survey of its forested lands. As a result of the survey, we determined that 1,578 tons of carbon are sequestered each year and Colgate's 1,059 acres of forested land contains 165,491 tons of stored carbon. Given this information, Colgate has begun to count the amount of carbon sequestered by its forests in our Greenhouse Gas Inventory. The detailed methodology for this survey can be found on Colgate's sustainability website[17].

Purchased Offsets

In FY 2013, Colgate purchased enough renewable energy credits (RECs) to offset its electricity consumption. These offsets were purchased through Sterling Planet and accounted for a reduction of 1,693 tons of carbon.

Patagonia Sur

FY 2012 was the first year that Colgate purchased offsets from Patagonia Sur. Patagonia Sur is a Verified Carbon Standard (VCS) credited carbon offset vendor in Patagonia, Chile. Patagonia Sur is a for-profit conservation venture, which reforests and educates people about the Chilean environment. Patagonia Sur will plant the equivalent number of trees to absorb 5,000 tons of carbon from the atmosphere annually. The contact is set to last for the next 15 years.

Table 20. *Colgate's offsets and net greenhouse gas emissions, FY 2009 through FY 2012.*

Carbon Offsets and Net Greenhouse Gas Emissions							
Fiscal Year	Total Emissions (MTeCO2)	Total Carbon Offsets (MTeCO2)					Total Net Carbon Emissions (MTeCO2)
		Forest Sequestration	Renewable Energy Credits	Carbon Offset Purchases	Patagonia Sur Offsets	Total Carbon Offsets	
2009	17,353	1,239	-	9	-	1,248	16,105
2010	14,505	1,239	-	-	-	1,239	13,266
2011	16,194	1,239	-	-	-	1,239	14,955
2012	13,817	-	-	114	5,000	5,114	8,703
2013	13,841	1,578	1,693	-	5,000	8,271	5,570

[17] Methodology and results at: http://www.colgate.edu/docs/default-source/d_distinctly-colgate_sustainability_climate-action-planning_forest-management-land-use/here.pdf?sfvrsn=0

CONCLUSION

The 2013 Comprehensive Greenhouse Gas Inventory for Colgate University calculated Colgate's greenhouse gas emissions for FY 2013 in relation to our FY 2009 baseline. Since 2009, the university has reduced its gross emissions by 20 percent (from 17,353 MTeCO2 in FY 2009 to 13,841 MTeCO2 in FY 2013) and reduced our emissions per student (FTE) by 25 percent (from 6.23 MTeCO2/FTE in FY 2009 to 4.73 MTeCO2/FTE in FY 2013). This is all despite the fact that we have added an additional 150 students, 13 faculty members, and 9,543 square feet of building space. Not to mention a cooler winter in FY 2013 (compared to FY 2012) that resulted in a rise in the amount of stationary combustion of fossil fuels. The stationary combustion of fossil fuels (fuel oil #6, fuel oil #2, propane, and kerosene) and air travel continue to remain our largest source of emissions comprising almost two-thirds of our overall footprint.

Carbon sequestered by Colgate's forested land (previously estimated to be 1,239 MTeCO2) was determined to sequester 1,578 MTeCO2 a year. FY 2013 was the first year that Renewable Energy Credits were purchased to offset the electricity that the campus consumes. The total carbon offsets for FY 2013 was 8,271 tons MTeCO2. This decreased our gross emissions from 13,841 MTeCO2 to our net value of 5,570 MTeCO2.

On September 15, 2011, Colgate's Sustainability and Climate Action Plan was approved by President Jeffrey Herbst and our senior administration. The Plan is a guiding document to climate neutrality in 2019 and includes 27 projects that will reduce our campus carbon footprint. As we continue to implement the plan, we anticipate achieving a 35 percent reduction in emissions from our FY 2009 baseline sooner than our original estimate of FY 2015.

Appendix A: Faculty and Staff Commuting Survey

Colgate Annual Staff and Faculty Transportation Survey

Employee commuting is responsible for roughly 10% of Colgate's emissions. This annual survey is designed to provide a reliable estimate of these emissions and to evaluate progress in reducing them.

Commuter Information

Please describe your driving commute for the 12 month period from September 1, 2012-August 31, 2013. For each of the time periods below, please state the number of days per week you drove.

Note: do not include days in which you are riding in someone else's car (including spouse or partner).

A note to new employees: If you started at Colgate within the last 12 months, but you replaced another employee, please complete the form *as if* you had been here all year. If your position was newly created, insert zero (0) for the time periods you were not here.

FALL 2012: ____

SPRING 2013: ____

SUMMER 2013: ____

On the days that you drove, how far did you drive *ONE WAY* to Colgate? Enter a whole number; round up to 1 if it's less than a 1 mile drive. If your driving is being compensated by Colgate, it should not be included in this mileage total.

_____

Please enter the number of days per week for each alternative commute method. Enter zero (0) if you did not use these methods during the specified time period. Note: carpooling with a spouse or partner is considered riding in someone else's car.

	Walked or Biked	Carpooled	Worked from home	Other
Fall 2012				
Spring 2013				
Summer 2013				

Car Information

Please estimate your primary car's fuel economy. If you do not drive a car, you can skip the question. The fuel economy of your car can be found at fueleconomy.gov by clicking on "Find and Compare Cars."

_____

Is there a secondary vehicle you use to commute to work?

If your commute was too complicated to be described on this survey, you can explain it below.