

2012

COLGATE UNIVERSITY'S



2012 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

SUSTAINABILITY AND CLIMATE ACTION PLAN

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
BoHP	Boiler Horsepower
CA-CP	Clean Air – Cool Planet
CAP	Climate Action Plan
CH ₄	Methane
CO ₂	Carbon Dioxide
COVE	Colgate's Center for Outreach, Volunteerism, and Education
MTeCO ₂	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
F-SEM	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
N ₂ O	Nitrous Oxide
NSF	National Science Foundation
PFC	Perfluorocarbons
PPA	Power Purchase Agreement
SF ₆	Sulfur Hexafluoride
WBCSD	World Business Council on Sustainable Development
WRI	World Resources Institute

ACKNOWLEDGEMENTS

2012 GREENHOUSE GAS INVENTORY

The following individuals made significant contributions to this report. Without their assistance, the collection of inventory data and the final production of this report would not have been possible.

Peter Babich, Associate Director of Facilities and Manager of Engineering Services

Brian Belden, Physical Plant Foreperson

Birnie Bus Co., Hamilton

Jill Burdick, Human Resources Associate

John Collins, Director of Budget

Amy Davidson, Facilities Department Office Manager

Rachel DiDomizio, Associate Director of the COVE

Paul Fick, Associate Vice President for Facilities

Lori Godshalk, Athletics Department Administrative Assistant

Emmett House, Supervisor of Athletics Grounds

Mike Jasper, Associate Director of Facilities and Manager of Lands and Grounds

Bob Keats, Director of Document and Mail Services

Sue Marks, Campus Safety Administrative Assistant

Jon McConville, Golf Course Superintendent

Carrie McFall, Facilities Administrative Assistant

Penny Intel, Administrative Coordinator, Dean of Faculty

Tom O'Neill, Associate VP/Controller of the Accounting Office

Tracy Ogren, Accounting Assistant

Beth Parks, Associate Professor and Chair of Physics and Astronomy

Dan Partigianoni, Associate Controller and Director of Financial Reporting

Art Punsoni, Director of Purchasing

Trish St. Leger, Associate Provost

Brendt Simpson, Director of Institutional Planning and Research

EXECUTIVE SUMMARY

SUSTAINABILITY AND CLIMATE ACTION PLAN

This report provides the methods and results of Colgate University's 2012 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 full 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 v6.85 also recommended in the ACUPCC guidelines. This is our fourth consecutive year completing Colgate's greenhouse gas inventory. Colgate's greenhouse gas emissions were 17,353, 14,505, 16,194, and 13,817 metric tons of carbon dioxide equivalent (MTeCO₂) for the years 2009, 2010, 2011, and 2012, 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 3,536 MTeCO₂ (from 17,353 in 2009 to 13,817 MTeCO₂ in 2012), or by 20.4 percent. This marked the lowest level of emissions since we began measuring our comprehensive greenhouse gas footprint in 2009. Colgate was able to accomplish this despite adding an additional 150 students, 13 additional faculty, and a new 15,000 square-foot building (Trudy Fitness Center). Colgate University accomplished these reductions by implementing effective behavior change programs, numerous energy conservation and efficiency projects, and meticulous implementation of the projects specified in our 2011 Sustainability and Climate Action Plan.

Other notable accomplishments in FY 2012 included the first time in Colgate's history where no department purchased non-recycled (virgin) paper and that we offered carbon neutral sugar cane paper. The sugar cane paper is made from the husks of sugar cane. It is considered a bi-product of the sugar cane industry and thus has no emissions associated with production. It was also the first year that emissions from our landfill waste were negative due to Colgate's continued reduction in landfill trash coupled with Madison County's methane capture and electricity generation facility.

FY 2012 also marked the first year that the university accounted for the Colgate Forest growing in Patagonia, Chile. The Colgate Forest is a Verified Carbon Standard (VCS) certified offset project in partnership with Patagonia Sur, LLC. Carbon sequestered through the growth of newly planted native trees offset 5,000 tons of carbon in FY 2012. Colgate's faculty also purchased an additional 114 tons of carbon to offset a faculty development trip to India. As a result, the university's net footprint in FY 2012, when adjusted for all offset purchases (totaling 5,114 tons), is 8,703 MTeCO₂. Colgate's 2012 gross emissions were 4.71 MTeCO₂ per full-time student and 5.90 MTeCO₂ per 1,000 square-feet of building space. This is a reduction in emissions of 1.52 MTeCO₂ per student and 1.54 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 #6, fuel oil #2, kerosene, and propane) at 32 percent of our total emissions, business-related air travel at 28 percent, electricity at 13 percent, and faculty and staff commuting at 10 percent.

INTRODUCTION

2012 GREENHOUSE GAS INVENTORY

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 AASHE² 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 pledge³ 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. Today, there are over 665 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 inventory⁴. 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 fourth consecutive year completing Colgate's greenhouse gas inventory. Colgate's greenhouse gas emissions were 17,353, 14,505, 16,194, and 13,871 metric tons of carbon dioxide equivalent (MTeCO₂) for the years 2009, 2010, 2011, and 2012 respectively. Throughout this report, we provide the results of Colgate's 2009, 2010, and 2011 inventories; however, our focus here is on the 2012 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 2012 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 demonstrates 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 greenhouse gas footprint by 3,536 MTeCO₂ (or 20 percent) since 2009. This reduction is mainly the result of conservation and efficiency projects through a:

- 31 percent decrease in fuel oil consumption (174,024 gallons less in 2012 compared to 2009)
- 4 percent decrease in electricity consumption (1,180,208 kWh less in 2012 compared to 2009)
- 43 percent decrease in departmental paper consumption (5,524,060 sheets less in 2012 compared to 2009)
- 7 percent decrease in landfill waste (58 tons less in 2012 compared to 2009)

¹ Website: <http://www.presidentsclimatecommitment.org/>

² Association for the Advancement of Sustainability in Higher Education website: <http://www.aashe.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/portaldata/imagegallerywww/4352/ImageGallery/Greenhouse%20Gas%20Inventory%20-%20Final%20Report%20-%20Published%20Report.pdf>.

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 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 Plan⁵. 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 recent climate action planning efforts, Colgate was honored with ACUPCC's 2011 Climate Leadership Award⁶. 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://secondnaturebos.wordpress.com/2011/06/23/colgate-university-recognized-for-climate-leadership/>

UNDERSTANDING COLGATE'S GREENHOUSE GAS INVENTORY

2012 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 Protocol⁸. 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). It is important to note that in 2012 Colgate's fiscal year officially changed from July 1 through June 30 of each year. Previously the fiscal year ran from June 1 and ended May 31.

Throughout this report, whenever a year is mentioned (e.g., 2012) 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 Calculator⁹. 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

⁷ See the *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* for additional details. Website: 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>.

carried out by Colgate's own fleet of vehicles is categorized as a "Scope 1" emission 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 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 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 (Colgate Cruisers), air travel (paid by or through the university), paper use, and solid waste.

De Minimis 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 located 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 live either in the 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 a.m. and 3:30 p.m. on weekdays. For all of these reasons, we assumed that greenhouse gas emissions associated with student commuting are de minimis (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 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 also 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 Potentials

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 a 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 2012 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 greenhouse gas emissions are measured in the internationally recognized units of metric tons of carbon dioxide equivalents (represented as MTeCO₂). International protocol designates carbon dioxide as the standard by which other gasses 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.

Emission Factors

Emission 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 greenhouse gases 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 emission 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.*

Emission Factor	=	Greenhouse Gas #1	+	Greenhouse Gas #2	+	Greenhouse Gas #3
		(Global Warming Potential) X (Rate of Emissions)		(Global Warming Potential) X (Rate of Emissions)		(Global Warming Potential) X (Rate of Emissions)
FUEL OIL #6	=	Carbon Dioxide (CO2)	+	Methane (CH4)	+	Nitrous Oxide (N2O)
		1 x 11.24 kg/gallon		25 x 0.00158 kg/gallon		298 x 0.000095 kg/gallon
FUEL OIL #6	=	Carbon Dioxide (CO2)	+	Methane (CH4)	+	Nitrous Oxide (N2O)
		11.24 kg/gallon		0.0395 kg/gallon		0.02831 kg/gallon
FUEL OIL #6 = 11.30 kg or 0.01130 MTeCO2/gallon						

Emission factors for Colgate University's greenhouse gas emitting activities were taken directly from the Clean Air-Cool Planet Campus Carbon Calculator (Table 2).

Table 2. Emission factors used to quantify Colgate's 2012 greenhouse gas emissions.¹⁰

COLGATE ACTIVITY	EMISSION FACTOR
Scope 1	
Fuel Oil #6 (Gallons)	0.0113029857509841 MTeCO ₂ / Gallon
Fuel Oil #2 (Gallons)	0.0103198266698413 MTeCO ₂ / Gallon
Propane (Gallons)	0.00526604195885714 MTeCO ₂ / Gallon
Biomass (Wood Chips)	1.58357698946667 MTeCO ₂ / Gallon
Gasoline Vehicles (Gallons)	0.00909726474219938 MTeCO ₂ / Gallon
Diesel Vehicles (Gallons)	0.0103478463174603 MTeCO ₂ / Gallon
Refrigerant (HFC-134a)	0.6486370891 MTeCO ₂ / lb
Refrigerant (HCFC-22)	0.771107029 MTeCO ₂ / lb
Fertilizer (Organic)	0.00414122989933616 MTeCO ₂ / lb Nitrogen
Scope 2	
Electricity (kWh)	0.0000596931 MTeCO ₂ / kWh
Scope 3	
Faculty/Staff Commuting (Miles)	0.000376383983936465 MTeCO ₂ / Mile
Faculty/Staff Commuting (Gallons)	0.00909726474219938 MTeCO ₂ / Gallon
Colgate Cruisers (Miles)	0.000324059838068358 MTeCO ₂ / Mile
Colgate Cruisers (Gallons)	0.0103478463174603 MTeCO ₂ / Gallon
Outsourced Bus Travel (Miles)	0.000324059838068358 MTeCO ₂ / Mile
Outsourced Bus Travel (Gallons)	0.0103478463174603 MTeCO ₂ / Gallon
Air Travel (Miles)	0.000546154126429841 MTeCO ₂ / Mile
Landfill Waste (no CH ₄ recovery)	3.1 MTeCO ₂ /Short Ton
Landfill Waste (w/ CH ₄ recovery)	(0.03) MTeCO ₂ /Short Ton
Non-Recycled Paper (lbs)	0.001365993362025 MTeCO ₂ / lb
30% Recycled Paper (lbs)	0.00121698827505 MTeCO ₂ / lb
50% Recycled Paper (lbs)	0.001067983188075 MTeCO ₂ / lb
100% Recycled Paper (lbs)	0.000769973014125 MTeCO ₂ / lb

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

2012 GREENHOUSE GAS INVENTORY

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 mid-October of each year (giving employees the necessary time to finish their end of the fiscal year reporting and get settled into the new academic year).

The annual data collection process will 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. Over the past couple of years, we have made a considerable effort to explain to the various departments and personnel what the purpose of the inventory is, why we are doing it, and informing them that this data will be requested again on an annual basis. We anticipate that this will help speed the data collection process for future inventories. 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 built-in formulas. The Workbook can be obtained 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 for enough time to circulate the report (internally) before publishing online to the ACUPCC Reporting System¹¹ by our bi-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. Furthermore, 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 through 2012.

Table 3. *Colgate's institutional data for Fiscal Years 2009 through 2012.*

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	\$ 600,220	\$ 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

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

Budget Information

Data Requested: The operating, research and energy budgets for FY 2012.

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 2012.

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 2012.

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

ENERGY AND WATER COSTS

Tracking energy and water costs are also useful 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 useful 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 2012.*

ENERGY AND WATER COSTS							
Fiscal Year	Wood Chips	Fuel Oil #6	Fuel Oil #2	Kerosene	Propane	Electricity	Water
	(\$/ton)	(\$/gallon)	(\$/gallon)	(\$/gallon)	(\$/gallon)	(\$/kWh)	(\$/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

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 2012.

Key Contact(s): Director of Purchasing (Art Punsoni) can provide the contractual pricing for all fuels.

Wood Chips (cost per ton)

Data Requested: Cost per ton of wood chips for FY 2012.

Key Contact(s): Associate Director of Facilities and Manager of Engineering Services (Peter Babich).

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

Data Requested: Cost per kilowatt-hour (kWh) of electricity and cost per 1,000 gallons of water for FY 2012.

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, total cost includes:

1) Normal Rate Charge. The Village of Hamilton uses primarily hydropower which is obtained from Niagara Falls. The Village is allocated 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.

2) 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 rate (and often higher rate) than our normal rate electricity.

3) 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 one 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 timeframe.

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 cubic 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 percent 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 2012.

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 (Peter Babich).

Table 5. *Colgate's emissions associated with wood chip combustion, FY 2007 through FY 2012.*

Fiscal Year	Wood Chips (Tons)	Emission Factor (MTeCO₂/Ton)	GHG Emissions (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	0.15835769	3,439

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 college-owned facilities or vehicles, fugitive emissions from refrigerant chemicals, and emissions associated with grounds maintenance.

On-Campus Stationary Combustion of Fossil Fuels

Colgate University uses four types of fossil fuels to provide heat and hot water to campus buildings: 1) 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, and 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 space 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 select buildings including 80 Broad Street, Seven Oaks Club House and Repair Shop, Schupf Art Studio, 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 sources, FY 2009 through FY 2012.

On-Campus Stationary Combustion of Fossil Fuels				
Fiscal Year	Fuel Type	Consumption (gallons)	Emission Factor (MTeCO ₂ /gallon)	GHG Emissions (MTeCO ₂)
2009	Fuel Oil #6	371,457	0.011761262	4,369
	Fuel Oil #2	185,503	0.010049435	1,864
	Kerosene	-	0.010049435	
	Propane	-	0.005440764	
2010	Fuel Oil #6	283,974	0.011761262	3,340
	Fuel Oil #2	174,399	0.010049435	1,753
	Kerosene	4,604	0.010049435	46
	Propane	-	0.005440764	
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

Fuel Oil #6

Data Requested: Gallons of fuel oil #6 consumed for FY 2012.

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 (Peter Babich). Director of Sustainability (John Pumilio) has access.

Fuel Oil #2

Data Requested: Gallons of fuel oil #2 consumed for FY 2012.

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 (Peter Babich). Director of Sustainability (John Pumilio) has access.

Kerosene

Data Requested: Gallons of kerosene consumed for FY 2012.

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

Propane

Data Requested: Gallons of propane consumed for FY 2012.

Key Contact(s): Director of Purchasing (Art Punsoni) 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 565 tons of greenhouse gas emissions in 2012, about 4 percent of Colgate's total emissions (Table 7).

Table 7. *Colgate's greenhouse gas emissions from university vehicle fleet, FY 2012.*

GASOLINE FLEET						
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)
35,016	5,099	3,664	1,446	45,225	0.009097	411
DIESEL FLEET						
B&G Diesel Pump		Golf Course Diesel Pump		Total Diesel	Emission Factor	GHG Emissions
(Gallons)		(Gallons)		(Gallons)	(MTeCO2/gallon)	(MTeCO2)
9,925		4,948		14,873	0.010348	154
TOTAL VEHICLE FLEET EMISSIONS:						565

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

1. Buildings 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 2012.

Key Contact(s): Director of Purchasing (Art Punsoni) 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 2012.

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

Buildings and Grounds Vehicles Fueled Off-Campus

Data Requested: Gallons of gasoline consumed for FY 2012.

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

Data Received: Data arranged in monthly spreadsheets from which total FY gallons purchased was calculated.

Campus Safety Vehicles Fueled Off-Campus

Data Requested: Gallons of gasoline consumed for FY 2012.

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

Data Received: Data arranged in monthly spreadsheets from which total FY gallons purchased was calculated.

Refrigerants (HFC-134a 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, the 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, HFC-134a accounted for over 64 metric tons of greenhouse gas emissions and HCFC-22 accounted for over 528 metric tons of emissions (Table 8).

Table 8. *Greenhouse gas emissions from HFC-134a and HCFC-22 refrigerant chemical use, FY 2012.*

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	543.5	0.771107029	419	449

HFC-134a

Data Requested: The total usage (in pounds) of the refrigerant type HFC-134a for FY 2012.

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 2012.

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 2012

Fertilizer Application (Organic)					
Fiscal Year	Landscaping	Golf Course	Total Fertilizers (lbs)	Emission Factor (MTeCO ₂ /lb)	GHG Emissions (MTeCO₂)
	Total (lbs of nitrogen)	Total (lbs of nitrogen)			
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

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 2012.

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 2012 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 2012, 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 2012, 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 2012.*

Purchased Electricity			
Fiscal Year	Total	Emission Factor	GHG Emissions
	(kWh)	(MTeCO ₂ /kWh)	(MTeCO₂)
2008	30,783,478	5.96931E-05	1,838
2009	31,571,030	5.96931E-05	1,885
2010	30,264,128	5.96931E-05	1,807
2011	30,883,211	5.96931E-05	1,844
2012	30,390,822	5.96931E-05	1,814

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 Survey Monkey 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.

2012 Annual Commuter Survey

Data Needed: Gallons of gasoline consumed through faculty and staff commuting in FY 2012.

Key Contact(s): Chair of the Transportation Subcommittee (Beth Parks) administers the annual survey and analyzes the results. Administrative Coordinator, Dean of Faculty (Penny Mintel) emails the survey to the campus community via Campus Distributions.

Data Received: The 2012 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 333 individuals who completed the survey.

Calculations: Based on 333 responses, the average Colgate employee used 162 gallons of gasoline in FY 2012 to commute back and forth to work. Multiply 162 gallons by 956 employees equals 154,872

gallons in total for FY 2012. Multiply 154,872 gallons by the emissions factor for gasoline (0.009097265 MTeCO₂ per gallon) equals 1,409 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 2012.*

Faculty and Staff Commuting			
Fiscal Year	Total Gasoline	Gasoline Emission Factor	GHG Emissions
	(Gallons)	(MTeCO ₂ /gallon)	(MTeCO ₂)
2010	157,740	0.008928806	1,408
2011	153,057	0.008928806	1,367
2012	154,872	0.009097265	1,409

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 2012.

Key Contact(s): The Birnie Bus terminal in Hamilton, NY (315-824-1260) provides the Cruiser data upon request.

Athletics Travel

Data Requested: Gallons of diesel consumed in FY 2012 for bus service for varsity athletic travel.

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

Data Received: Gallons of diesel consumed for FY 2012 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 2012.*

Directly Financed Outsourced Bus Travel							
Fiscal Year	Cruiser	Diesel Emission Factor	GHG Emissions	Athletics Travel	Diesel Emission Factor	GHG Emissions	TOTAL GHG Emissions
	(Gallons)	(MTeCO ₂ /gallon)	(MTeCO ₂)	(Gallons)	(MTeCO ₂ /gallon)	(MTeCO ₂)	(MTeCO ₂)
2009	7,230	0.010077767	73	18,335	0.010077767	185	258
2010	7,144	0.010077767	72	18,683	0.010077767	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

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 vehicle¹². 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 \$3.54 (the national average cost per gallon of gasoline¹³) in order to determine the total gallons of gasoline consumed.

Table 13. *Greenhouse gas emissions from employee business ground travel, FY 2012.*

Employee Business Ground Travel							
Fiscal Year	Reimbursement Cost (-387)	Reimbursement for Gasoline	Total Reimbursement for Gasoline	Average Cost per Gallon of Gasoline	Total Gasoline Consumption	Gasoline Emission Factor	GHG Emissions
	(\$)	(%)	(\$)	(\$)	(Gallons)	(MTeCO ₂ /Gallon)	(MTeCO₂)
2011	\$ 286,687	57%	\$ 163,412	\$ 3.05	53,578	0.008928806	478
2012	\$ 339,941	60%	\$ 203,965	\$ 3.54	96,029	0.009097265	874

Air Travel

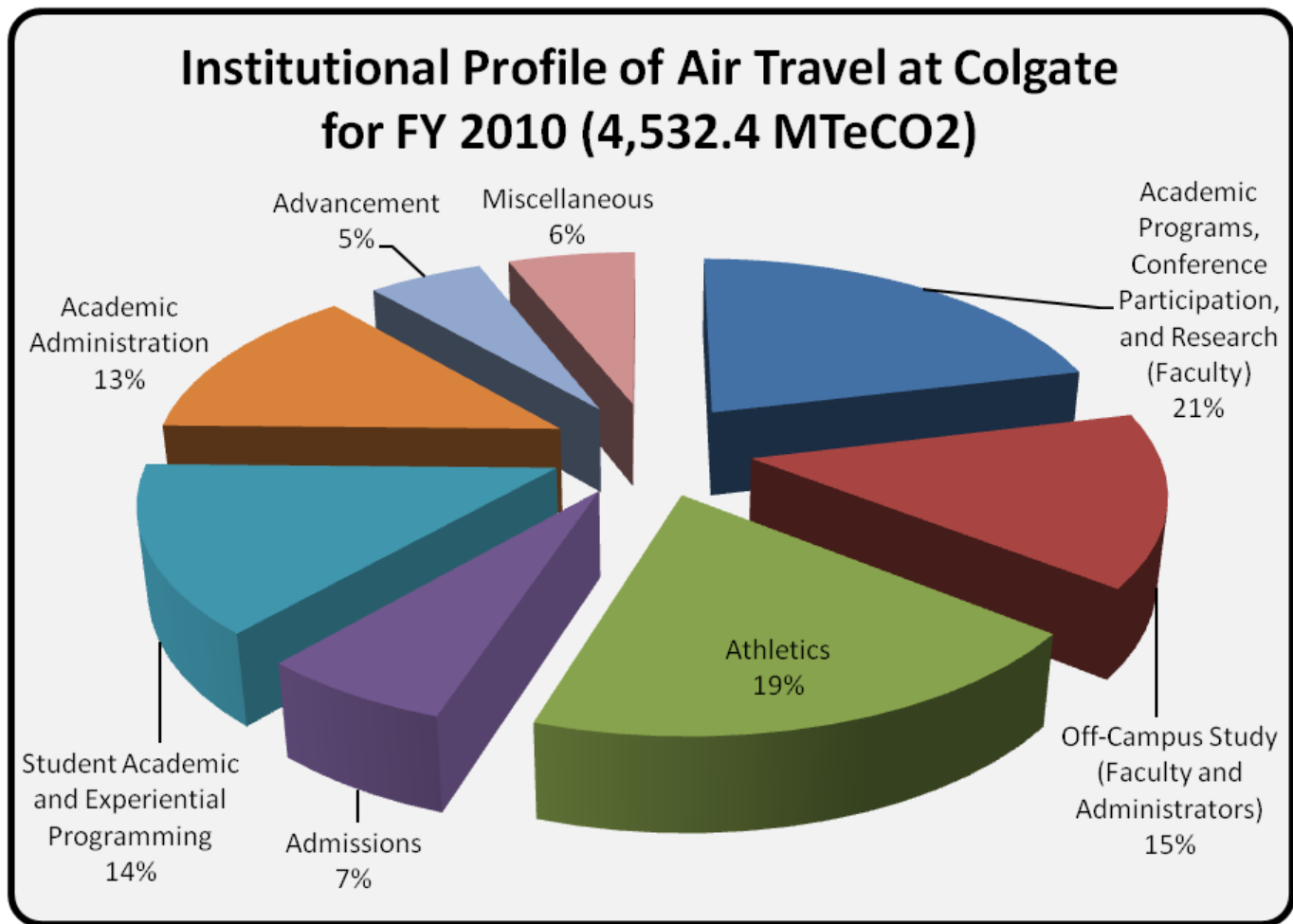
Air travel plays a vital role in many university functions, a role that is arguably exacerbated by Colgate's rural location and our commitment to certain institutional priorities. Faculty travel by air to support research and conference participation, for example, and professional staff throughout the 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.

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.

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. Annual COVE flights are also calculated into Colgate's greenhouse gas emissions (Table 14).

Table 14. *Greenhouse gas emissions from air travel, FY 2009 through FY 2012.*

Air Travel						
Fiscal Year	Business	Athletics	COVE	Total	Air Travel Emission Factor	GHG Emissions
	(Miles)	(Miles)	(Miles)	(Miles)	(MTeCO ₂ /Mile)	(MTeCO ₂)
2009	5,960,140	19,461	5,966	5,985,567	0.000776369	4,647
2010	5,838,481	525,790	63,746	6,428,017	0.000776369	4,991
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

Accounting Code -386

Data Requested: Annual air travel paid for by or through the university to conduct Colgate business in FY 2012 in miles.

Key Contact(s): Staff Accountant (Leta Wiley).

Data Received: Total 2011 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 2012 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 America¹⁴, 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 $(16.47 + (16.47 \times .20)) = 19.76\text{cents per mile} = 6,914,119 \text{ miles}$.
- $6,914,119 \text{ miles} \times 0.00054615412642984 \text{ MTeCO}_2/\text{mile} = 3,826 \text{ metric tons of greenhouse gas emissions (MTeCO}_2\text{)}$.

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.

Center for Outreach Volunteerism and Education (COVE)

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").

Data Requested: Annual air travel paid for through the COVE in FY 2012 in miles.

Key Contact(s): Associate Director, COVE (Rachel DiDomizio).

Data Received: COVE annual flight itineraries and number of Colgate students/staff on those flights.

Calculations: We are able to calculate the roundtrip distance between airports using Travel Math's online Flight Distance Calculator¹⁵. The roundtrip distance per flight is multiplied by the number of passengers to get the total passenger miles traveled (Table 15). The total air miles traveled is then multiplied by the emissions factor for air travel to get greenhouse gas emissions.

Table 15. Greenhouse gas emissions from air travel sponsored by the COVE, FY 2012.

FY 2012 COVE Flights				
FLIGHT	People	Roundtrip Distance (miles)	Total Passenger Miles	MTeCO ₂ /Mile
Syracuse to charolette	12	1,190	14,280	8
Charolette to Birmingham	12	720	8,640	5
syracuse to JFK	12	412	4,944	3
JFK to santo domingo	12	3,090	37,080	20
syracuse to chicago	9	1,186	10,674	6
chicago to Rapid City	9	1,606	14,454	8
Chicago phil syr	1	1,259	1,259	1
TOTAL	67	9,463	91,331	71

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 campus¹⁶. 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 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 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 16).

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;

¹⁵ The calculator was accessed online in December 2012 at: <http://www.travelmath.com/flying-distance/>.

¹⁶ The trucks that transport Colgate's landfill waste and recyclables are fueled at the Buildings and Grounds diesel pump. Therefore, the emissions associated with the diesel trucks are captured in the diesel fuel pump data.

- 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 2012.

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 16. Colgate's greenhouse gas emissions associated with landfill waste, FY 2008 through FY 2012.

Landfill Waste					
Fiscal Year	Landfill Waste	Emission Factor	GHG Emissions	Full-time Equivalent Students	GHG Emissions per FTE
	(Short Tons)	(MTeCO ₂ /Short Ton)	(MTeCO ₂)	(FTEs)	(MTeCO ₂)
2007	938	1.0842857	1,017	2,734	0.37
2008	929	1.0842857	1,007	2,767	0.36
2009	813	1.0842857	881	2,784	0.32
2010	778	0.1606349	125	2,770	0.05
2011	794	0.160634921	128	2,876	0.04
2012	754	(0.0300000)	(23)	2,934	-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 17) and the more environmentally benign.

Table 17. Colgate's greenhouse gas emissions associated with paper consumption, FY 2010 and FY 2012.

Paper Consumption						
Fiscal Year	Paper Type (% Recycled)	Departmental Consumption (lbs)	Print Shop Consumption (lbs)	TOTAL Consumption (lbs)	Emission Factor (MTeCO ₂ /lbs)	GHG Emissions (MTeCO ₂)
2010	0%	21,613	19,888	41,501	0.001290500	54
	30%	42,157	9,270	51,427	0.001170973	60
	50%	1,825	14,664	16,489	0.001051445	17
	100%	21,482	950	22,432	0.000812390	18
	TOTAL	87,077	44,772	131,849		149
2011	0%	15,616	19,517	35,133	0.001290500	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	0.000812390	19
	TOTAL	89,835	39,778	129,613		145
2012	Tree-Free paper	4,056		4,056		
	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

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 2012.

Key Contact(s): Director of Purchasing (Art Punsoni).

Comments: The Office of Sustainability and Purchasing department eliminated the option to purchase non-recycled paper in FY 2012.

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 departmental purchasing (sheets of paper consumed), FY 2009 through FY 2012.

Departmental Paper Consumption								
Fiscal Year	Tree-Free Paper	Non-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	12,877,624	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	-	3,546,535	686,238	2,719,280	7,353,564	2,934	2,506

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 2012.

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 19. Colgate Print Shop (sheets of paper consumed), FY 2009 through FY 2012.

Print Shop Paper Consumption							
Fiscal Year	Non-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

COLGATE'S GROSS GREENHOUSE GAS EMISSIONS

2012 GREENHOUSE GAS INVENTORY

Colgate's greenhouse gas footprint was 17,353 MTeCO₂ (6.23 tons / FTE¹⁷) in 2009, 14,505 MTeCO₂ (5.24 tons / FTE) in 2010, 16,194 MTeCO₂ (5.63 tons / FTE) in 2011 and 13,817 MTeCO₂ (4.71 tons/FTE) in 2012 (Table 20). 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 Plan¹⁸.

Table 20. Colgate's gross greenhouse gas emissions by source and scope for FY 2009 through FY 2012.

FISCAL YEAR	2009	2010	2011	2012
SOURCE OF EMISSIONS	TONS OF EMISSIONS			
SCOPE 1				
Fuel Oil #6	4,368	3,339	3,451	2,435
Fuel Oil #2	1,864	1,752	1,909	1,729
Kerosene	-	46	83	83
Propane	-	-	177	165
Vehicle Fleet	393	524	587	565
Refrigerants (HFC-134a and HCFC-22)	1,247	84	592	449
Fertilizer	46	21	24	28
SCOPE 1 TOTAL	7,918	5,767	6,823	5,454
SCOPE 2				
Purchased Electricity	1,885	1,807	1,844	1,814
SCOPE 2 TOTAL	1,885	1,807	1,844	1,814
SCOPE 3				
Faculty/Staff Commuting	1,626	1,408	1,367	1,409
Bus Travel (Cruisers/Athletics)	258	260	296	318
Employee Business Ground Travel	-	-	478	874
Air Travel	4,647	4,990	5,104	3,826
Landfill Waste	881	125	139	-23
Paper Consumption	139	148	145	145
SCOPE 3 TOTAL	7,550	6,931	7,529	6,549
FTE	2,784	2,770	2,876	2,934
TONS / FTE	6.23	5.24	5.63	4.71
GROSS EMISSIONS	17,353	14,505	16,194	13,817

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

¹⁷ FTE = Full-time equivalent student.

¹⁸ Website: <https://sites.google.com/a/colgate.edu/2011-2015-sustainability-and-climate-action-plan/>

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 2012. "Others" include fertilizer use (28 MTeCO₂), Bus Travel (318 MTeCO₂), and paper consumption (145 MTeCO₂).

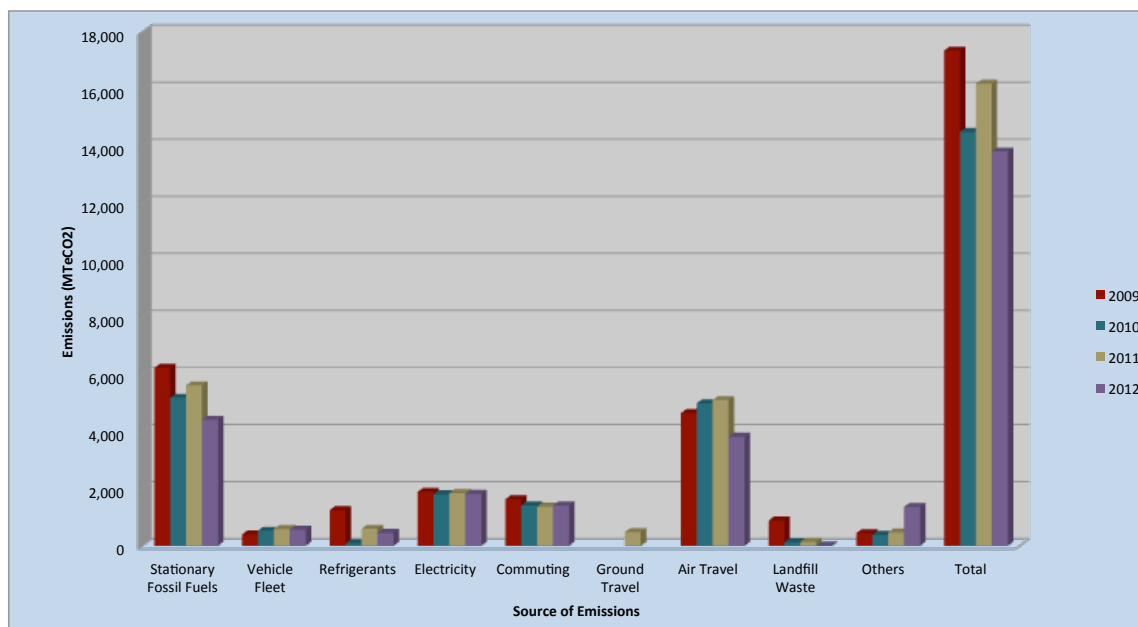
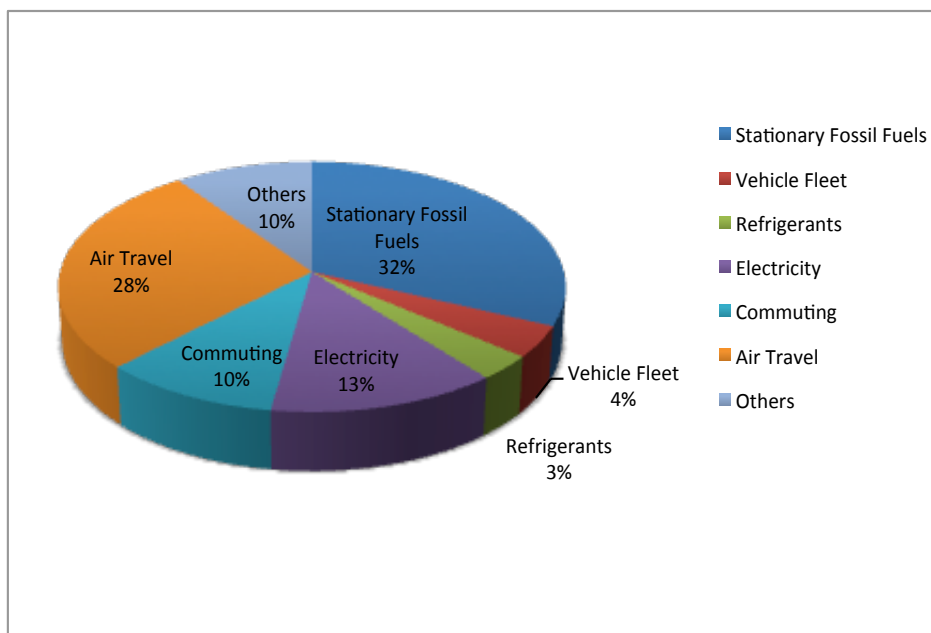


Figure 4. FY 2012, percentage of gross emissions by source. "Other" includes fertilizer use (28 MTeCO₂), landfill waste (-23 MTeCO₂), and paper consumption (145 MTeCO₂).



CARBON OFFSETS AND NET GREENHOUSE GAS EMISSIONS

2012 GREENHOUSE GAS INVENTORY

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 2012, 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 2012 is 7,609 MTeCO₂ (Table 21).

Forest Preservation

In previous years we have included an estimate of carbon sequestered by forested area on Colgate lands. In FY 2012 year we are currently in the process of creating a more accurate assessment of what our forests can sequester. Based on preliminary results we have decided to not continue to include the previous estimate of 1,239 MTeCO₂ until we get a more accurate calculation.

Purchased Offsets

In FY 2012 a group of faculty members went on an academic, university-sponsored trip to India. The university permitted the emissions from their flights to be offset through the Patagonia Sur reforestation project in Patagonia, Chile. In total the group offset their flights with an equivalent of 114 tons of carbon offsets.

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. In FY 2012 Colgate began claiming the offsets of the Colgate Forest we have contracted with Patagonia Sur. Our contract states that Patagonia Sur will plant the equivalent number of trees to absorb 5,000 tons of carbon from the atmosphere annually. The contract is set to last for the next 15 years.

Table 21. Colgate's offsets and net greenhouse gas emissions, FY 2009 through FY 2012.

CARBON OFFSETS AND NET GREENHOUSE GAS EMISSIONS							
Fiscal Year	Total Emissions (MTeCO ₂)	Total Carbon Offsets (MTeCO ₂)					Total Net Carbon Emissions (MTeCO ₂)
		Forest Sequestration	Renewable Energy Credits	Carbon Offset Purchases	Patagonia Sur Offsets (tons)	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

CONCLUSION

2012 GREENHOUSE GAS INVENTORY

The 2012 Comprehensive Greenhouse Gas Inventory for Colgate University calculated Colgate's greenhouse gas emissions for FY 2012 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 13,817 MTeCO₂ in FY 2012) and reduced our emissions per student (FTE) by 25 percent (from 6.23 MTeCO₂/FTE in FY 2009 to 4.71 MTeCO₂/FTE in FY 2012). This is despite the fact that we have added an additional 150 students, 13 faculty members, and a new 15,000 square foot fitness center. 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 owned land (previously estimated to be 1,239 MTeCO₂) was temporarily removed from the inventory for FY 2012 until a more accurate estimate is available. However, FY 2012 was the first year in which offsets were purchased, including the 5,000 tons contracted annually to Patagonia Sur. The total carbon offsets (without Colgate-owned forests) for FY 2012 was 5,114 tons MTeCO₂. This decreased our gross emissions from 13,817 MTeCO₂ to our net value of 8,703MTeCO₂.

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 implement the plan, we anticipate achieving a 35 percent reduction in emissions from our FY 2009 baseline by FY 2015.