2011

COLGATE UNIVERSITY'S

SUSTAINABILITY AND CLIMATE ACTION PLAN

Colgate University
13 Oak Drive
Hamilton, NY 13346

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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
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
B&G	Colgate's Buildings and Grounds
B20	Diesel blend containing 20% biodiesel and 80% petrodiesel
BAU	Business-As-Usual Scenario
BoHP	Boiler Horsepower
CAFE	Corporate Average Fuel Economy
CAP	Climate Action Plan
CFL	Compact Fluorescent Lamp
CH4	Methane
CHOP	Colgate Hunger Outreach Program
CLSI	Colgate's Center for Leadership and Student Involvement
CMH	Community Memorial Hospital
CNY	Central New York
CO2	Carbon Dioxide
Coop	Colgate's O'Connor Campus Center
COVE	Colgate's Center for Outreach, Volunteerism, and Education
CU	Colgate University
DEC	New York State Department of Environmental Conservation
ECM	Energy Conservation Measure
eCO2	Equivalents of Carbon Dioxide
EIA	U.S. Department of Energy's Energy Information Administration
ENST	Colgate's Environmental Studies Program
EPA	U.S. Environmental Protection Agency
EPEAT	Electronic Product Environmental Assessment Tool
F-SEM	Colgate's First-year Seminar
FTE	Full-time Equivalent Student
FY	Fiscal Year (June 1 to May 31)
GEG	Colgate's Green Earth Gang
GHG	Greenhouse Gas
GPM	Gallon Per Minute
GS	Green Seal
HD	High Definition
HFCs	Hydrofluorocarbons
HOG	Colgate's Hamilton Outdoor Group
HVAC	Heating, Ventilation & Air Conditioning
IEEE	Institute of Electrical and Electronics Engineers
ITS	Colgate's Information Technology Services
KW	Kilowatt
kWh	Kilowatt-hour
Lbs	Pounds
LCD	Liquid Crystal Display

ACRONYM	MEANING
LEED	Leadership in Energy and Environmental Design
LOFT	Colgate's Leadership Options for Tomorrow
MFDs	Multi-function Devices
MMBtu	One Million British Thermal Units
MPG	Miles per Gallon
MTeCO2	Metric Tons of Carbon Dioxide Equivalent
N2O	Nitrous Oxide
Nat Gas	Natural Gas
NYSERDA	New York State Energy Research and Development Authority
PC	Personal Computer
PDAs	Personal Digital Assistant
PFCs	Perfluorocarbons
RA	Residential Adviser
RECs	Renewable Energy Certificates
ROI	Return on Investment
SCADA	Supervisory Control And Data Acquisition
SEA	Colgate's Students for Environmental Action
SF6	Sulphur hexafluoride
SGA	Colgate's Student Government Association
STARS	Sustainability Tracking, Assessment, and Rating System
TIA	Thought into Action Institute
USDA	United States Department of Agriculture
USGBC	U.S. Green Building Council
VCS	Verified Carbon Standard
VERs	Voluntary Emissions Reductions
VOC	Volatile Organic Compound
VOiP	Voice over Internet Protocol
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
YRS	Years

ACKNOWLEDGEMENTS

SUSTAINABILITY AND CLIMATE ACTION PLAN

Colgate's Sustainability and Climate Action Planning effort was guided and supported by the strong leadership of **President Jeffrey Herbst**. We commend him for championing sustainability and committing Colgate to the worthy pursuit of climate neutrality. Central to this report was **David Hale**, associate vice president for finance and administration. His direction and valuable insights greatly enhanced the integrity of this report. Sustainability at Colgate and the process of climate action planning benefited tremendously from the support of **Lyle Roelofs** who served as interim president and provost and dean of the faculty as we put this plan together.

The preparation of the final report was led by members of Colgate's Sustainability Council represented by **Christopher Henke**, council chair and associate professor of sociology, **Barbara Brooks**, director of public relations and marketing, **Julie Dudrick**, Upstate Institute project director, **Paul Fick**, associate vice president for facilities, **Tim McCay**, associate professor of biology and environmental studies, **Michael Michonski '12**, **Lauren Miller '11**, **Beth Parks**, associate professor of physics and astronomy, **Cary Peppermint**, assistant professor of art and art history, **John Pumilio**, sustainability coordinator, **Geoffrey Reid**, assistant director of residential education for civic engagement and diversity initiatives, **Abby Rowe**, director of outdoor education, and **Trish St. Leger**, associate provost.

Council members worked hand in hand with Colgate's Climate Action Plan Steering Committee which helped to coordinate the efforts of the Climate Action Plan Subcommittees. The Steering Committee included **Ian Helfant**, associate dean of the faculty and associate professor of Russian, **Christopher Henke**, **Paul Fick**, **John Pumilio**, and **Trish St. Leger**. Over the course of 18 months, the Steering Committee met weekly to plan and coordinate activities.

This report would not have been possible without the effort and dedication of the Climate Action Plan Subcommittee members who contributed their time and expertise to this endeavor. They researched and explored potential mitigation strategies for Colgate to reduce its greenhouse gas emissions. Subcommittees and members included:

Air Travel Subcommittee
Ian Helfant, Chair, associate dean of the faculty
Barbara Gorka, study abroad
Katrina Swartout-Ryan, admissions
Thirza Morreale, advancement
Ann Marie Guglieri, athletics
Tom O'Neill, accounting

Energy Subcommittee
Paul Fick, Chair, associate VP for facilities
Geoffrey Reid, residential life
Trish St. Leger, associate provost
Bruce Selleck, professor of geology
Peter Babich, college engineer
Beth Parks, associate professor of physics

Ground Transportation Subcommittee
Beth Parks, chair, associate professor of physics
Carolee White, finance and administration
Tim McCay, director of environmental studies
Lori Godshalk, athletics
Mike Jasper, facilities
Lori Chlad, human resources
Joanne Borfitz, community affairs
Abby Rowe, outdoor education

Land Use and Grounds Maintenance Subcommittee
Mike Jasper, chair, facilities
Jon McConville, golf course
Emmett House, facilities
Chris Henke, associate professor of sociology

Waste Minimization and Recycling Subcommittee
John Pumilio, chair, Sustainability Office
George Murray, dining services
Bob Pils, facilities
Hugh Bradford, off-campus study
Ross Miller, ITS
Fouad Saleet, Center for Leadership & Involvement
Art Punsoni, purchasing

Offsets Subcommittee
Bob Turner, chair, director of Division of Social Sciences
Trish St. Leger, associate provost
Tom O'Neill, accounting
Rich April, professor of geology

Engineering firm **O'Brien & Gere** provided expert consultation in helping us with the energy portion of our plan. Their professionalism helped Colgate better understand our opportunities associated with energy conservation and efficiency.

The Heating Plant Upgrade Feasibility Study was completed by an expert team of individuals and firms who have considerable work experience at Colgate. The team was composed of:

- **Peterson Guadagnolo Engineers, PC** (lead firm)
- **Combustion Designs, Inc.** (major equipment)
- **Buck Engineering** (environmental and permitting)
- **Klepper, Hahn, and Hyatt, PC** (structural and civil engineering)

Due to the technical complexity of the decision-making process, high cost, and long-range impact of determining Colgate's energy future, we are grateful for the expert analyses and long-standing professional partnerships we have with these firms.

Sustainability Office intern **Ben Taylor '10** led the effort to complete Colgate's 2009 baseline greenhouse gas inventory that is our key benchmark for this report. Over the course of a few months, Taylor compiled and analyzed data and helped to write the final report. Summer 2010 sustainability interns **Meghan Kiernan '11** and **Andrew Pettit '11** did terrific work advancing sustainability on campus. Kiernan helped to create and implement our Green Living Program and recycling efforts. Pettit created an input tool that simplified our greenhouse gas inventory process and he completed a cost-benefit analysis for composting that was referenced in this report.

Students in CORE 128 (2009), F-SEM 124 (2010), ENST 480 (2009 and 2010), and ENST 390 (2011) contributed valuable research and helped improve our understanding of sustainability on campus. These students made much of the data in this report possible and we are grateful for the leadership of **Professor Catherine Cardelus**, **Professor Robert Turner**, and **Professor Frank Frey**.

Finally, this plan has benefited from the efforts and enthusiasm of hundreds of Colgate students who participate in the Green Summit each year and who serve on one or more of the numerous sustainability-oriented groups on the Colgate campus.

EXECUTIVE SUMMARY
SUSTAINABILITY AND CLIMATE ACTION PLAN

Modern society's consumptive patterns and the design of our manufacturing and industrial systems consume natural resources, energy, and minerals at ever-increasing rates. Our current cultural, economic, and political systems encourage intensive and extensive use of natural resources that, through their extraction and consumption, create pollution, waste, and social and environmental inequities. The evidence is compelling that these patterns of production and consumption are negatively impacting ecosystems and biodiversity and are making humans more vulnerable to environmental hazards. Further, this evidence also points to considerable and increased risks—especially through, but not limited to, climate change—in the coming century if we continue our current practices. Simply put, our current way of living is unsustainable, and overcoming this presents a great challenge in our time.

Colgate University continues to be a leader in higher education by advancing the practice and teaching of sustainability. In 2005, Colgate's Sustainability Council was formally charged by Colgate's president to develop a coordinated environmental vision to ensure a safe, healthy, and sustainable environment. Ultimately, the Council seeks to advise and guide the university on ways to integrate teaching, research, operations, and community engagement to address current and future sustainability challenges. In January of 2009, Colgate became a signatory of the American College and University Presidents' Climate Commitment (ACUPCC), challenging Colgate to develop and implement actions to achieve climate neutrality by eliminating or offsetting 100 percent of the university's greenhouse gas emissions. Signing the ACUPCC is Colgate's most significant commitment to sustainability and further demonstrates leadership by example as Colgate strives to meet our academic mission to *"produce ethical and moral leaders who inspire others."* By striving for and achieving climate neutrality, Colgate is helping to educate and prepare the next generation of community, corporate, non-profit, and public leaders.

Colgate has already demonstrated leadership in sustainability and made important progress in advancing sustainability on campus. In 2010, for example, we reduced our greenhouse gas emissions by 17 percent (from 17,323 MTeCO2 in 2009 to 14,451 MTeCO2 in 2010). This reduction is mainly the result of conservation and efficiency projects through:

- a 24 percent decrease in fuel oil consumption (nearly 88,000 gallons less in 2010 compared to 2009)
- a 4 percent decrease in electricity consumption (1.3 million kWh less in 2010 compared to 2009)
- a 33 percent decrease in paper use (43,000 lbs less in 2010 compared to 2009)
- a 4 percent decrease in landfill waste (34 tons less in 2010 compared to 2009)

Conservation and efficiency saved the university nearly $300,000 in operating costs while enhancing our liberal arts education as student participation was integral to these results through academic research, governance, and co-curricular club activities.

Additionally, Colgate's wood-fired boiler uses over 20,000 tons of locally grown wood chips to provide heat and hot water to campus. In 2010, our wood-fired boiler displaced over one million gallons of fuel oil, avoided over 13,000 metric tons of emissions, and saved the university over $2 million in energy costs. We are also experimenting with cropped biomass in the form of an eight-acre willow plot in the hopes of cultivating some of our own energy.

Colgate's electronic waste recycling program includes 18 stations located throughout campus; we also recently implemented a new composting program and broke ground on a new half-acre community vegetable garden. Vegetables and herbs from the garden are sold back to the university and served in our dining halls. Each program was funded, in part, by the Class Gift of 2010 and students are helping to manage each of these initiatives. Colgate's administration leads by creating opportunities and opening pathways for student research and innovation.

Regarding transportation, in 2010, we expanded our Green Bikes program by purchasing an additional 12 bikes and introduced a new online rideshare program in order to help reduce employee-commuting emissions.

Colgate's Green Office Program is indicative of our participatory and inclusive approach. In 2010, eight teams representing 65 employees registered for and are actively pursuing official Green Office Certification.

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 numerous courses focused on sustainability and climate change.

As a result of these efforts, Second Nature recognized Colgate as a 2011 Climate Leadership Award recipient during its annual Climate Leadership Summit in Washington, D.C. With our wood-fired boiler, low-carbon electricity grid, sustainability-focused academic programming, and a campus culture conducive to sustainability, Colgate is well-positioned to continue as a leader in sustainability in the 21st century. With the completion of this Sustainability and Climate Action Plan, Colgate now has a comprehensive set of specific, measurable, and tangible goals for sustainability to guide our progress and set our direction. With this plan, Colgate will build on recent accomplishments and intensify our efforts to advance sustainability.

Colgate has set an ambitious target date of 2019—to coincide with our bicentennial celebration—for achieving climate neutrality. Meeting this goal will require the purchase of a substantial number of carbon offsets. As a result, our climate action planning efforts will continue well beyond our climate neutrality date as we continue to implement projects and policies that will reduce our campus's gross emissions and, therefore, our dependency on carbon offsets. In light of this, the university established complementary goals to reduce our gross emissions in the coming years:

- By 2015, reduce gross greenhouse gas emissions to 11,249 MTeCO2 or 35% below the 2009 baseline.
- By 2020, reduce gross greenhouse gas emissions to 10,412 MTeCO2 or 40% below the 2009 baseline.

The Sustainability and Climate Action Plan is a year-by-year road map to advance sustainability and achieve climate neutrality by 2019. Throughout the planning process, the Climate Action Plan Steering Committee and Subcommittees worked to identify mitigation projects that could be implemented within the next four years. In the end, we agreed on 27 individual projects that will advance sustainability on campus while reducing our greenhouse gas emissions. The Climate Action Plan table below lists each of the projects and ranks them according to the amount of metric tons of carbon dioxide equivalent (MTeCO2) reduced. The first 11 projects on the list will reduce Colgate's greenhouse gas emissions by over 3,500 MTeCO2 or 95% of all greenhouse gas reductions identified in this plan.

Climate Action Plan: *project ranking by total greenhouse gases (MTeCO2) reduced.*

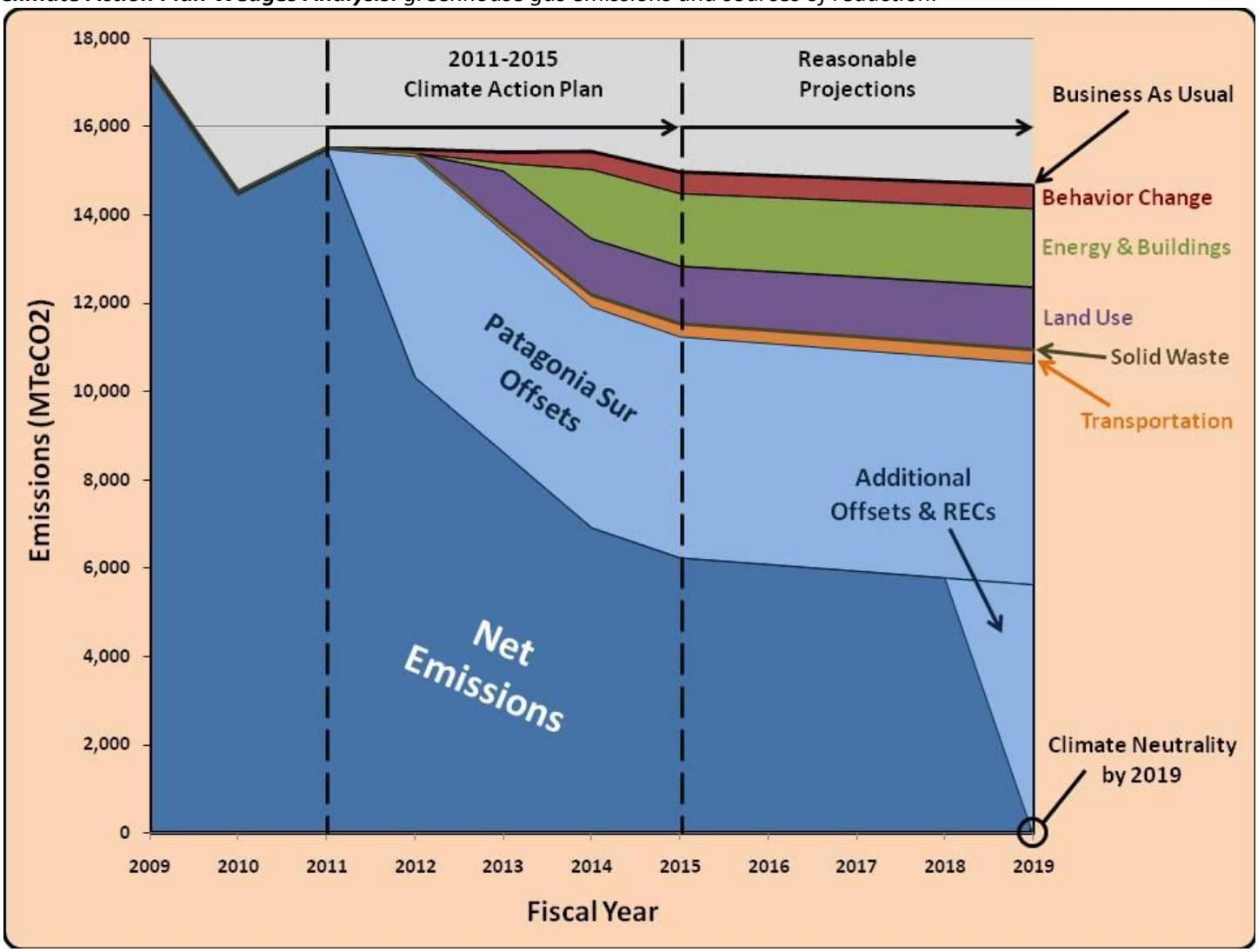
RANK	MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	FIVE YEAR $/MTeCO2
1	Fuel switching: eliminate fuel oil #6	$ 7,300,000	$ -	$ (366,000)	19.9	1,258	$ 4,348
2	Forest sequestration (carbon accounting project)	$ 30,000	$ -	$ -	N/A	1,239	$ 24
3	Green Living Program	$ 38,300	$ 45,500	$ (104,700)	0.8	276	$ (934)
4	Green Office Program (40 new offices; 240 employees)	$ -	$ 2,000	$ (109,900)	0.0	188	$ (2,870)
5	Videoconferencing	$ 35,200	$ -	$ (19,000)	1.9	100	$ (598)
6	Olin Hall (energy conservation measures)	$ 148,300	$ -	$ (34,700)	4.3	92	$ (274)
7	Low-flow showerheads	$ 9,800	$ -	$ (51,900)	0.2	90	$ (2,774)
8	Reforestation of open spaces (8 acres)	$ 5,400	$ -	$ -	N/A	80	$ 68
9	Carpooling (48 carpools)	$ -	$ 500	$ -	N/A	72	$ 35
10	Geothermal heat exchange	$ 125,000	$ -	$ (15,000)	8.3	72	$ 697
11	McGregory Hall (energy conservation measures)	$ 96,900	$ -	$ (21,500)	4.5	60	$ (175)
12	Sanford Field House (energy conservation measures)	$ 64,500	$ -	$ (25,600)	2.5	35	$ (1,804)
13	Adaptive computer power management	$ 14,400	$ 2,700	$ (17,000)	1.0	23	$ (2,531)
14	On-site composting (pre- and post-consumer)	$ 7,000	$ 4,100	$ (8,100)	1.4	21	$ (619)
15	Encourage flexible work schedules	$ -	$ -	$ -	N/A	21	$ -
16	Implement 'no-idling' policy	$ 1,000	$ -	$ (5,200)	0.2	13	$ (1,996)
17	Employee bicycle commuting (30 bikes & 10 bike racks)	$ 8,500	$ 5,100	$ -	N/A	12	$ 2,931
18	Purchase electric vehicles (6)	$ 9,000	$ -	$ (6,600)	1.4	11	$ (2,176)
19	Biodiesel (B20 blend)	$ -	$ -	$ (500)	0.0	11	$ (227)
20	Purchase hybrid-electric vehicles (3)	$ 6,000	$ -	$ (3,000)	2.0	8	$ (1,076)
21	Establish 'reduced mow' areas (30 acres)	$ 1,800	$ -	$ (1,800)	1.0	6	$ (1,200)
22	Solar thermal energy	$ 27,500	$ -	$ (1,300)	21.2	6	$ 3,573
23	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	0.0	3	$ (6,333)
24	Green events: waste minimization and recycling	$ -	$ -	$ (600)	0.0	2	$ (1,500)
25	Trayless dining operations (Frank Dining Hall)	$ 90,000	$ -	$ (100,700)	0.9	2	$ (206,750)
26	Wind energy	$ 86,000	$ -	$ (2,400)	35.8	2	$ 43,529
27	$50 minimum purchasing order	$ -	$ -	$ (500)	0.0	1	$ (2,500)
CLIMATE ACTION PLAN TOTAL		**$ 8,105,000**	**$ 60,000**	**$ 914,000**	**9.1**	**3,700**	**$ 1,055**

Projects range from low-cost, high-impact behavior-change strategies such as the Green Office and Green Living Programs, to capital-intensive and technologically complex engineering projects such as the heating plant upgrade (fuel switching from #6 oil to natural gas). By 2015, our goal will be to implement these projects and in the process:

- eliminate fuel oil #6 consumption on campus by replacing it with natural gas (depending on its future availability in Hamilton, N.Y.)
- reduce electricity consumption by nearly 5,000,000 kWh
- reduce fuel oil #2 consumption by over 10,000 gallons
- reduce gasoline consumption by over 3,000 gallons
- reduce diesel consumption by 800 gallons
- reduce water consumption by nearly 6,000,000 gallons
- reduce landfill waste by over 300 tons
- reduce paper consumption by over 10,000 pounds
- reduce food purchasing expenditures by over $100,000
- reduce air travel expenditures by nearly $20,000

Cumulatively, these projects are expected to eliminate approximately 3,700 tons of greenhouse gas emissions (see the Climate Action Plan Wedges Analysis graph below). Each wedge in the graph contains projects that will reduce emissions within that category: behavior change, energy and green building, land use and grounds maintenance, solid waste and recycling, transportation, and offset projects. The black line at the top of the graph—delineating the business-as-usual scenario—represents Colgate's estimated emissions if the university took no specific actions to reduce greenhouse gas emissions.

Climate Action Plan Wedges Analysis: *greenhouse gas emissions and sources of reduction.*



The Sustainability and Climate Action Plan is fiscally responsible. The one-time implementation cost (first cost) will be approximately $8.1 million; however, $7.3 million of that includes the heating plant upgrade project that needs to occur regardless of our sustainability and climate action planning efforts. We anticipate that by implementing the cumulative suite of projects, we will reduce our annual operating budget by over $750,000 (see Climate Action Plan Financial Analysis table below).

Climate Action Plan Financial Analysis: *first cost, annual operating cost/savings, and net cost/savings by fiscal year.*

FIRST COST	2012	2013	2014	2015	TOTAL
ALL PROJECTS (except Heating Plant)	$ 15,000	$ 380,000	$ 191,000	$ 219,000	$ 805,000
HEATING PLANT	$ -	$ -	$ 7,300,000	$ -	$ 7,300,000
TOTAL	**$ 15,000**	**$ 380,000**	**$ 7,491,000**	**$ 219,000**	**$ 8,105,000**

PROJECTED OPERATING COST (Cumulative)	2012	2013	2014	2015
ALL PROJECTS (except Heating Plant)	$ 11,000	$ 35,000	$ 48,000	$ 60,000
HEATING PLANT	$ -	$ -	$ -	$ -
CARBON OFFSET PURCHASES	$ 50,000	$ 50,000	$ 50,000	$ 98,000
TOTAL	**$ 61,000**	**$ 85,000**	**$ 98,000**	**$ 158,000**

PROJECTED SAVINGS (Cumulative)	2012	2013	2014	2015
ALL PROJECTS (except Heating Plant)	$ (76,000)	$ (334,000)	$ (469,000)	$ (548,000)
HEATING PLANT	$ -	$ -	$ (366,000)	$ (366,000)
TOTAL	$ (76,000)	$ (334,000)	$ (835,000)	$ (914,000)

NET OPERATING COST/(SAVINGS)	2012	2013	2014	2015
ALL PROJECTS (except Heating Plant)	$ (65,000)	$ (299,000)	$ (421,000)	$ (488,000)
HEATING PLANT	$ -	$ -	$ (366,000)	$ (366,000)
CARBON OFFSET PURCHASES	$ 50,000	$ 50,000	$ 50,000	$ 98,000
TOTAL	**$ (15,000)**	**$ (249,000)**	**$ (737,000)**	**$ (756,000)**

Finally, it is important to emphasize that the Sustainability and Climate Action Plan is a living document. Surely, new research, policies, incentives, partnerships, organizational structures, and technologies will create opportunities not available today. For this reason, we must remain vigilant and open to reevaluating and revising our strategies when better ones emerge.

To meet this end, the process of revising and enhancing our Sustainability and Climate Action Plan in the months and years ahead was not an afterthought, but built directly into our ongoing effort. We have devoted a section of our sustainability and climate action planning website to encourage feedback, new ideas, and participation from the Colgate community and all interested stakeholders. We will incorporate feedback, new research, and emerging technologies and opportunities into the updated version of our Sustainability and Climate Action Plan due on January 15, 2013. Moreover, we will further communicate Colgate's ongoing progress through the publication of our annual Greenhouse Gas Inventory and through the publication of the Sustainability Office's Annual Sustainability Review. We anticipate that our interactive website and these updated publications will significantly enhance our sustainability program by helping to capture the collective knowledge and insights from our diverse, scholarly, and multidisciplinary community.

MISSION STATEMENT

To promote educational opportunities, foster partnerships, provide leadership, and contribute practical solutions to advance environmental stewardship, social justice, and fiscal responsibility at Colgate University.

VISION STATEMENT

Colgate's sustainability program strives to:

i. enhance Colgate's liberal arts education by working with faculty and staff to integrate the concept and practice of sustainability into our curriculum;

ii. promote a learning and work environment that is environmentally and socially conscious;

iii. integrate sustainability into our operations, day-to-day practices, and into our built environment; and

iv. advance sustainability in the Central New York region through collaboration with local institutions, agencies, and individuals.

1.1 COLGATE AT A GLANCE

Colgate University is a private liberal arts college located in the Village of Hamilton in Madison County, New York, USA. The school was founded in 1819 as a Baptist seminary and today is non-denominational.

Colgate University owns about 1,780 acres of land in a rural setting in Central New York. The main campus includes 160 buildings and 2,331,239 square feet of built environment on 515 acres of land. Another 876 acres is protected forest, and the remaining 389 acres are leased to local farmers for crop and dairy production. Colgate was recognized as the most beautiful campus in the country in the 2010 edition of the *Princeton Review*.

Colgate has approximately 2,900 full-time students in 52 undergraduate majors. Colgate is a residential campus and all but approximately 250 students live in campus housing. The university employs 278 faculty members and 678 staff.

As of December 31, 2009, Colgate's endowment was valued at $607 million, and students pay approximately $52,880 for tuition and room and board per year. In 2009[1], Colgate's operational budget was $147,320,539, and our energy budget was $4,712,740.

Colgate operates a central heating and cooling plant that provides heat and domestic hot water for 37 main campus buildings. Since 1981, Colgate has been using biomass to meet the majority of its heating and hot water requirements. In 2009, Colgate used 22,249 tons of wood chips in the central plant (Table 1). Colgate's backup heat supply is residual oil number 6 (fuel oil #6). When the outside temperature drops below 35°F, Colgate must use fuel oil #6 to supplement the biomass boiler to provide necessary heating to its buildings. In FY 2009, Colgate used 371,457 gallons of fuel oil #6.

Table 1. *Utility unit cost and energy use at Colgate University, FY 2009.*

COLGATE UTILITY	QUANTITY	UNIT COST	TOTAL COST	MMBTU / UNIT	TOTAL MMBTU	$ / MMBTU	ANNUAL GHG EMISSIONS (MTeCO2)
Electricity (kWh)	31,571,030	$ 0.042	$ 1,325,983	0.003413	107,752	$ 12.31	1,885
Wood Chips (tons)	22,249	$ 40.00	$ 889,960	11.500000	255,864	$ 3.48	-
Fuel Oil #6 (gallons)	371,457	$ 2.24	$ 832,064	0.150110	55,759	$ 14.92	4,368
Fuel Oil #2 (gallons)	185,503	$ 3.50	$ 649,261	0.138490	25,690	$ 25.27	1,864
Water (gallons)	85,551,000	$ 0.01083	$ 926,517				
TOTAL			$4,623,785		445,065		8,116

The majority of Colgate's auxiliary buildings (the buildings off the main steam line) use distillate oil number 2 (fuel oil #2) for heating and hot water. In 2009, Colgate used 185,503 gallons of fuel oil #2 (Table 1).

[1] Throughout this report, whenever a year (e.g., 2009) is referenced, it represents the fiscal year and not the calendar year. At Colgate, the fiscal year begins on June 1 and ends on May 31. Therefore, the year 2009 represents fiscal year 2009 that began on June 1, 2008 and ended on May 31, 2009. Fiscal year is also referenced as FY in this report (e.g., FY 2009).

Altogether, Colgate spent a total of $2,371,285 on various fuels in FY 2009 to heat both its on-campus and auxiliary buildings.

Additionally, Colgate buildings used a total of 31,571,030 kWh of electricity in FY 2009 (Table 1).

Colgate's vehicle fleet consists of 95 vehicles: 68 Buildings and Grounds vehicles, 22 student/faculty vans, and 5 Campus Safety vehicles. Combined, these vehicles consumed approximately 21,706 gallons of gasoline that accounted for 194 MTeCO2[2] in FY 2009 (Table 2).

Table 2: *Gasoline fleet average miles per gallon, mileage, fuel consumption and MTeCO2 for FY 2009.*

VEHICLE TYPE	AVERAGE MPG	TOTAL MILEAGE	TOTAL GALLONS (GASOLINE)	ANNUAL EMISSIONS (TONS)
Student/Faculty Vans (22)	17.5	165,356	9,449	84
B&G Vehicles (68)	16.4	165,938	10,118	90
Campus Safety (5)	22.6	48,344	2,139	19
TOTAL	18.8	379,638	21,706	193

1.2 SUSTAINABILITY AT COLGATE, CLIMATE CHANGE AND THE ACUPCC[3]

Modern society's consumptive patterns and the design of our manufacturing and industrial systems consume natural resources, energy, and minerals at ever-increasing rates. Our current cultural, economic, and political systems encourage intensive and extensive use of natural resources that, through their extraction and consumption, create pollution, waste, and social and environmental inequities. The evidence is compelling that these patterns of production and consumption are negatively impacting ecosystems and biodiversity, and are making humans more vulnerable to environmental hazards. Further, this evidence also points to considerable and increased risks—especially through, but not limited to, climate change—in the coming century if we continue our current practices. Simply put, our current way of living is unsustainable and overcoming this presents a great challenge in our time.

Awareness of these issues has grown over the past several decades, and we are now at a time when sustainability has emerged as a framework used to build organizational strength while overcoming core institutional challenges. Sustainability is reshaping the way institutions conceptualize their place in the larger system of global resources and risks. Increasingly, organizations, corporations, higher education institutions, and individuals are being scrutinized and judged by their commitment to and practice of sustainability. A growing number of employers are looking to hire graduates familiar with the practice and concept of sustainability and many potential employees prefer to work for organizations that embrace sustainability. These trends provide both challenges and opportunities for Colgate University and its mission of liberal arts education. Trends such as global climate change point to Colgate's connection to the global community, and the fact that our local operational inputs and outputs have much wider implications. This same interdependency means that economics and environmental factors will also become increasingly tied together, and the future financial stability of the institution will be determined by its resilience in the face of sustainability-driven challenges. In addition, questions of sustainability call for careful research using the latest theories and methods, providing many opportunities to serve Colgate's educational mission while preparing students for life and work in the 21st century. Finally, Colgate's focus on sustainability will highlight our role as a leader in this area, increasing our attractiveness to students and donors, and serving as a model for other institutions to emulate.

For these reasons, Colgate is committed to sustainability. Colgate's Sustainability Council[4] was charged in 2005 to develop a coordinated environmental vision for short-term and long-term planning to ensure a safe, healthy and

[2] MTeCO2 refers to metric tons of carbon dioxide equivalent or cumulative tons of greenhouse gas emissions including carbon dioxide, methane, nitrous oxide, and other greenhouse gases.
[3] ACUPCC = American College and University Presidents' Climate Commitment, www.presidentsclimatecommitment.org/.
[4] Sustainability Council website: http://www.colgate.edu/about/sustainability/sustainabilitycouncil.html.

sustainable environment. Ultimately, the council seeks to advise and guide the university on ways to integrate teaching, research, operations, and community engagement to address current and future sustainability challenges.

The university's most significant commitment to sustainability occurred in January 2009 when Colgate became a signatory to the American College and University Presidents' Climate Commitment (ACUPCC). This commitment requires Colgate to: 1) measure its baseline greenhouse gas emissions, 2) develop and implement mitigation strategies to reduce those emissions, and 3) achieve climate neutrality by offsetting the remaining emissions.

The Sustainability and Climate Action Plan was produced, in part, to fulfill the objectives of the Sustainability Council and the ACUPCC and, ultimately, to create a road map that will guide Colgate's journey towards a sustainable future. Completing the Sustainability and Climate Action Plan is a significant achievement for Colgate University. However, the completion of this plan is more of a beginning than an end. Indeed, the most difficult part of our sustainability efforts and climate neutrality goals lie ahead. Implementing the strategies highlighted in this report will challenge our resolve. Committing human resources and finances to support this effort will determine in large part whether our objectives are reached.

Finally, it is important to emphasize that this is a living document. Surely, new research, policies, incentives, partnerships, organizational structures, and technologies will create opportunities not available today. For this reason, we must routinely reevaluate and revise our goals and objectives.

2.0 GUIDING PRINCIPLES & DECISION-MAKING CRITERIA

SUSTAINABILITY AND CLIMATE ACTION PLAN

Planning for sustainability at Colgate requires a set of guiding principles that will serve as a framework for decision making. Integration of these principles into our day-to-day decisions will allow us to collectively advance sustainability on campus.

Colgate's Guiding Principles for a Sustainable Future:

- Foster opportunities that link the curriculum with operations in a way that supports Colgate's liberal arts education and gives students the opportunity to put sustainability theory into practice.
- Cultivate learning opportunities that engage students with the long-term social, environmental, and economic sustainability of Central New York.
- Promote a campus community that values cultural and ecological diversity.
- Provide a safe, healthy, and engaging work and living environment that fosters interaction, recreation, and education.
- Consider long-term impacts, lifecycle analyses, and integrated systems thinking in all our sustainability initiatives. Economic vitality, environmental quality, and social equity are interdependent and need to be considered holistically.
- New initiatives should support policies and programs that prioritize efficient use of, and reduced demand for, energy and natural resource extraction.
- Consider end-of-life disposal and recycling options when making purchasing decisions. Take necessary precautions to prevent environmental pollution and unnecessary landfill waste.
- Consider full-cost analysis including social and environmental impacts for our contracts, investments, and purchasing decisions.
- All things being equal, university investments should support companies that are socially responsible and are good environmental stewards.
- Favor policy, purchasing, and operational decisions that exert a positive influence in our bioregion. This includes decisions that minimize environmental impacts, support healthy communities, maximize long-term value, and contribute to local and regional economic health.

As we continue our journey towards a sustainable future, it is important to remain flexible and open to emerging technologies and new opportunities. As these opportunities present themselves, they should be evaluated using the following criteria:

- **Time horizon:** how important is early success or is success in the distant future worth striving for?
- **Achievability:** how likely is it that this goal can be attained?
- **Financial cost:** what financial resources would be required to support the proposed initiative and where would potential sources of funding come from?
- **Community readiness:** will various stakeholders support the proposed initiative or will it be unpopular or overly burdensome?
- **Impact:** if achieved, will the goal have a big influence or a marginal influence in Colgate's overall sustainability profile?
- **Ease of implementation:** will the work require considerable investment of institutional time and energy? How technically difficult would the initiative be to implement?

3.0 COLGATE'S GREENHOUSE GAS EMISSIONS
SUSTAINABILITY AND CLIMATE ACTION PLAN

This section explains the methods and results of Colgate University's baseline greenhouse gas emissions inventory for FY 2009. Colgate's inventory was completed in compliance with one of the key requirements of the American College and University President's Climate Commitment (ACUPCC) signed in January 2009 by former President Rebecca Chopp. The commitment mandates that participating universities complete an inventory within one year of their implementation start date and at least every other year thereafter[5].

3.1 DATA COLLECTION AND 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)[6] and The Climate Registry's General Reporting Protocol[7]. The *ACUPCC Implementation Guide* outlines these protocols as they relate to higher education institutions. Under these protocols, sources of greenhouse gas emissions are divided into three categories or "scopes." These are:

- Scope 1 Emissions. Scope 1 refers to direct GHG emissions occurring from sources that are owned or controlled by the institution.
- Scope 2 Emissions. Scope 2 refers to indirect emissions generated in the production of electricity consumed by the institution.
- 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 actual calculations were made using the emissions factors embedded in the Clean Air-Cool Planet's Campus Carbon Calculator v6.3[8] also recommended in the ACUPCC guidelines.

During the summer of 2009, sustainability intern Ben Taylor '10 worked with Colgate's Sustainability Office to complete the university's first comprehensive greenhouse gas inventory[9].

Organizational Boundary: In order to calculate Colgate's greenhouse gas emissions, we had to determine our organizational boundary. 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.

Operational Boundary: As an ACUPCC signatory, Colgate is expected to be consistent with the Greenhouse Gas Protocol and track and report on each of the six greenhouse gases covered under the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur 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 for by or through the university and regular commuting to and from campus.

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[5] See the *ACUPCC Implementation Guide, 2009* for additional details. Website: http://www.presidentsclimatecommitment.org/resources/publications

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

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

[8] Download the latest version of Clean Air-Cool Planet's Campus Carbon Calculator at http://www.cleanair-coolplanet.org/toolkit/inv-calculator.php

[9] Colgate's 2009 Baseline Greenhouse Gas Inventory can be downloaded at http://www.colgate.edu/about/sustainability/climateaction

3.2 EMISSION FACTORS

Emission factors for this report were taken directly from the Clean Air-Cool Planet's Campus Carbon Calculator v6.3 following The Climate Registry's General Reporting Protocol. Emission factors are used to provide an equivalent amount of carbon dioxide emissions for each of Colgate's activities. While some activities produce methane, nitrous oxide, or other greenhouse gases, international protocol designates CO2 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) because carbon dioxide is the most abundant anthropogenic greenhouse gas. The equivalents—obtained from the Clean Air-Cool Planet Campus Carbon Calculator—are used to convert emissions into the equivalent measure of metric tons of carbon dioxide (represented as MTeCO2). See Table 3.

Table 3. *The emission factors used for the calculation of MTeCO2 in this report.*
**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.*

COLGATE ACTIVITY	EMISSION COEFFICIENT
SCOPE 1	
Fuel Oil #6	0.011757907 MTeCO2 / Gallon
Fuel Oil #2	0.01004635 MTeCO2 / Gallon
Gasoline Vehicles	0.008924124 MTeCO2 / Gallon
Diesel Vehicles	0.0100761 MTeCO2 / Gallon
Refrigerent (HFC-134a)	0.589670081 MTeCO2 / lb.
Fertilizer (Organic)	0.004113436 MTeCO2 / lb. Nitrogen
SCOPE 2	
Electricity	0.0000596931 MTeCO2 / kWh
SCOPE 3	
Faculty/Staff Commuting	0.0004038 MTeCO2 / Mile
Outsourced Bus Travel	0.000254 MTeCO2 / Mile
Colgate Cruisers	0.0100761 MTeCO2 / Gallon
Air Travel	0.000776336 MTeCO2 / Mile
Landfill Waste (with CH4 recovery)	0.160634921 MTeCO2 / Short Ton
Landfill Waste (no CH4 recovery)	1.0842857 MTeCO2 / Short Ton
Non-Recycled Paper	0.0012905 MTeCO2 / lb.
30% Recycled Paper	0.001147067 MTeCO2 / lb.
50% Recycled Paper	0.001051445 MTeCO2 / lb.
100% Recycled Paper	0.00081239 MTeCO2 / lb.

3.3 BASELINE EMISSIONS AND SOURCES

Colgate's greenhouse gas footprint was 17,353 tons (6.23 tons / FTE[10]) in 2009 and 14,505 tons (5.24 tons / FTE) in 2010 (Table 4). This includes all Scope 1 emissions (on-site combustion of fuel oil, 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 commuting, air travel paid for by or through the university, paper use, and solid waste.

[10] FTE = Full-time equivalent student.

Table 4. *Colgate's total greenhouse gas emissions by source and scope for FY 2009 and 2010.*

FISCAL YEAR	2009	2010
SOURCE OF EMISSIONS	TONS OF EMISSIONS	
SCOPE 1		
Fuel Oil #6	4,368	3,339
Fuel Oil #2	1,864	1,752
Kerosene	-	46
Vehicle Fleet	393	524
Refrigerants	1,247	84
Fertilizer	46	21
SCOPE 1 TOTAL	7,918	5,767
SCOPE 2		
Purchased Electricity	1,885	1,807
SCOPE 2 TOTAL	1,885	1,807
SCOPE 3		
Faculty/Staff Commuting	1,626	1,408
Cruisers/Bus Travel	258	260
Air Travel	4,647	4,990
Landfill Waste	881	125
Paper Consumption	139	148
SCOPE 3 TOTAL	7,550	6,931
FTE	2,784	2,770
TONS / FTE	6.23	5.24
GROSS EMISSIONS	17,353	14,505

The two greatest contributors to Colgate's overall emissions across all scopes were "Fuel Oil" and "Air Travel." See Figures 1 and 2. Colgate consumes fuel oil, 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.

Figure 1. *Total emissions by source, FY 2009 vs. FY 2010.*

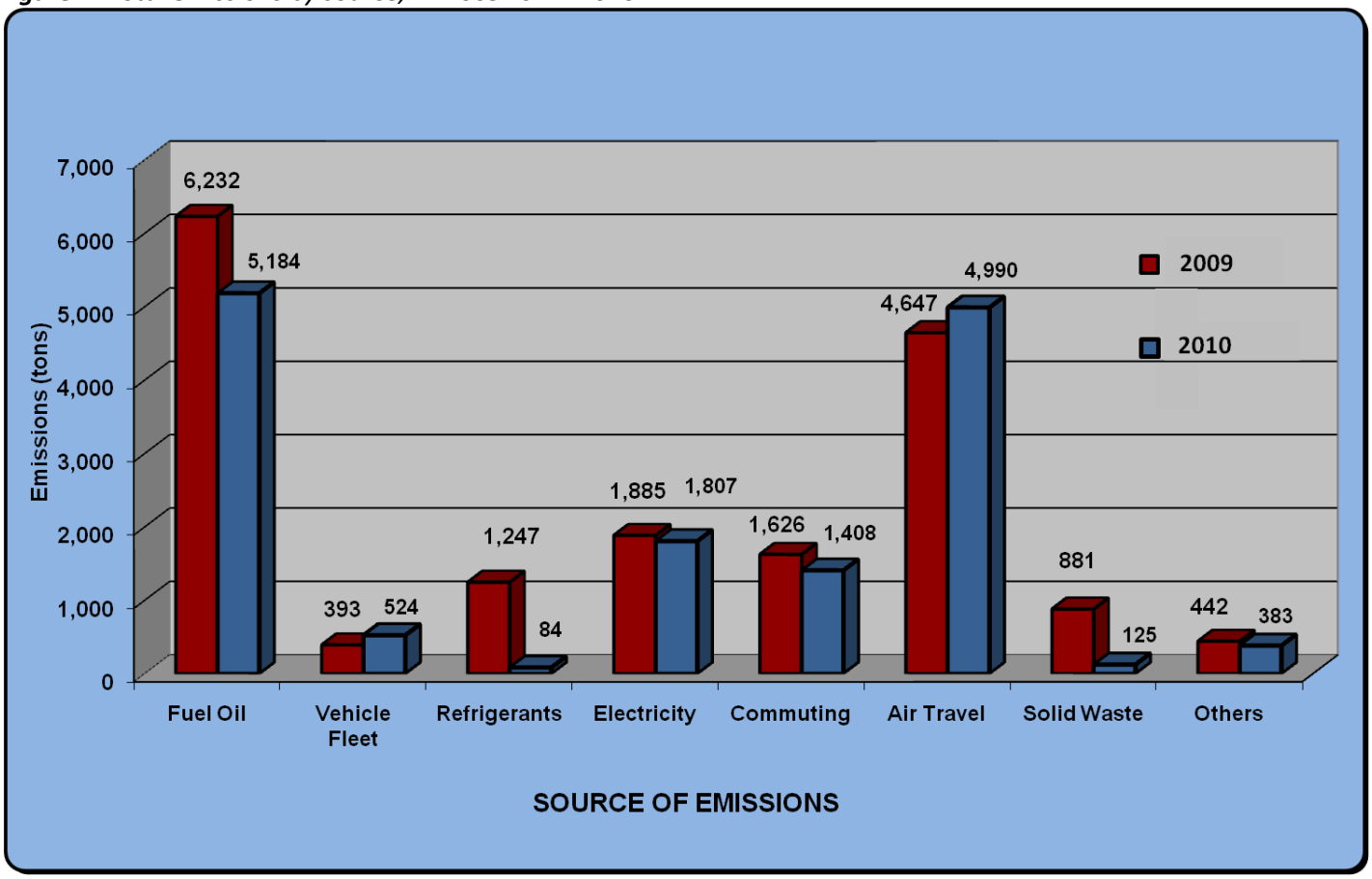
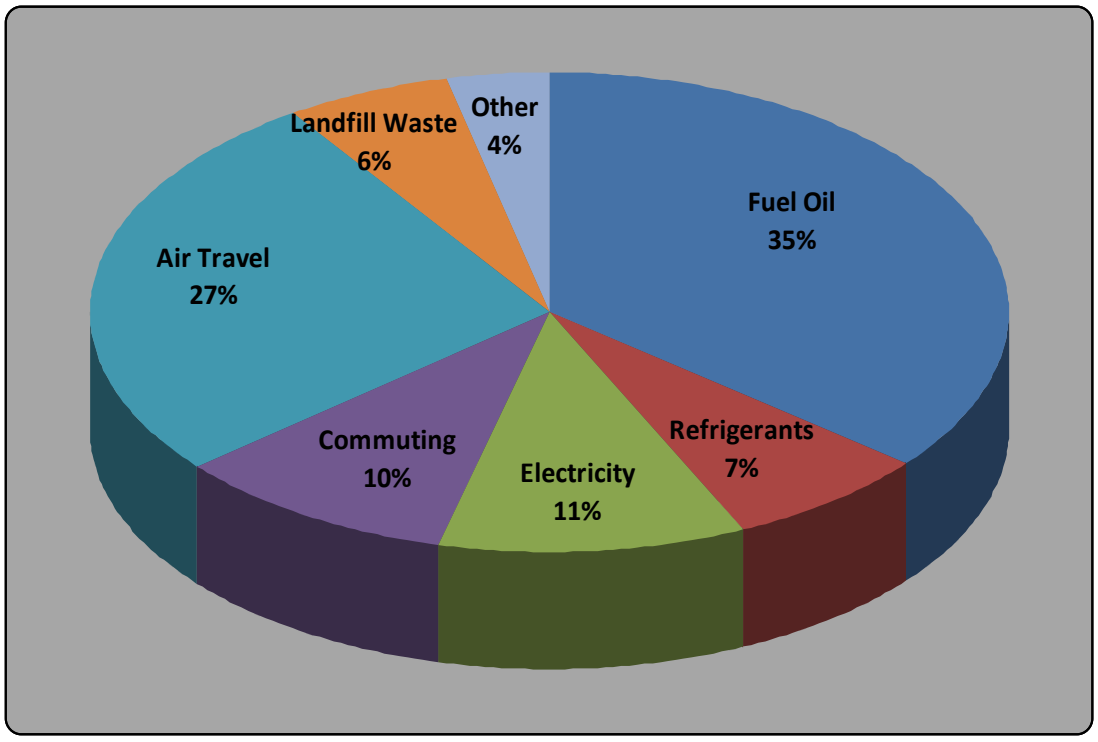


Figure 2. *FY 2009, percentage of total emissions. "Other" includes vehicle fleet, fertilizer use, Cruiser bus fleet, and paper consumption.*



De Minimus Emissions: Colgate is a residential campus with only 250 students (9% 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 minimus (less than 5% 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.

3.4 THIRD-PARTY VERIFICATION

ACUPCC signatories are not required to certify or verify their emissions inventory or climate action plan with a third party auditor. Nevertheless, signatories are expected to follow the guidelines in the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard which helps to ensure reports are complete and accurate. Signatories are also required to publicly report their emissions inventory and climate action plan to ACUPCC's online Reporting System. This form of public disclosure encourages self-regulation and is another way to help ensure the accuracy of reports.

3.5 BUSINESS-AS-USUAL SCENARIO

Colgate's business-as-usual scenario (BAU) forecasts campus emissions if we do not take any mitigation actions (Figure 3). We based our BAU scenario on future enrollment and emissions per FTE (Table 5). Colgate's emissions dropped from 17,353 MTeCO2 in 2009 to 14,505 MTeCO2 in 2010. We averaged 5.74 MTeCO2 of emissions per FTE for the two years we completed our inventory. Table 5 highlights Colgate's projected FTEs by fiscal year. Colgate plans to marginally increase enrollment in the years ahead from 2,784 FTE in 2009 to stabilize at 2,830 FTE by 2015 and beyond. Other key assumptions specific to Colgate's business-as-usual scenario include:

- A slight increase in fuel oil #6 and electricity emissions due to the addition of Colgate's new 15,000 square-foot fitness center that came online in January 2011. We assumed that the building would be 15% more energy efficient than our average building due to sustainable design.
- No new construction after 2011.
- Major renovations do not meet LEED Silver rating or better, resulting in buildings that use the same rate of energy in the future as today.
- An increase in enrollment from 2,784 FTE in 2009 to 2,830 by 2015 (Table 5).
- No change in electricity mix. We assume that hydroelectric will continue to provide 84% of our electricity with coal, nuclear, wind, and others rounding out our mix.
- Corporate average fuel economy (CAFE) improves by 42% by 2016 as specified under the new EPA mandate passed in 2010. We assume this improvement in gas mileage will result in a 3.81% per year improvement in fuel efficiency associated with Colgate's vehicle fleet and employee commuting until 2021.

Based on these assumptions, we estimate that Colgate's emissions will stabilize at 14,501 MTeCO2 by 2022 under a business-as-usual scenario (Figure 3; Table 5).

Figure 3. *Colgate's estimated emissions under a business-as-usual scenario (BAU). Under this scenario, Colgate's emissions will stabilize at 14,501 tons by 2022.*

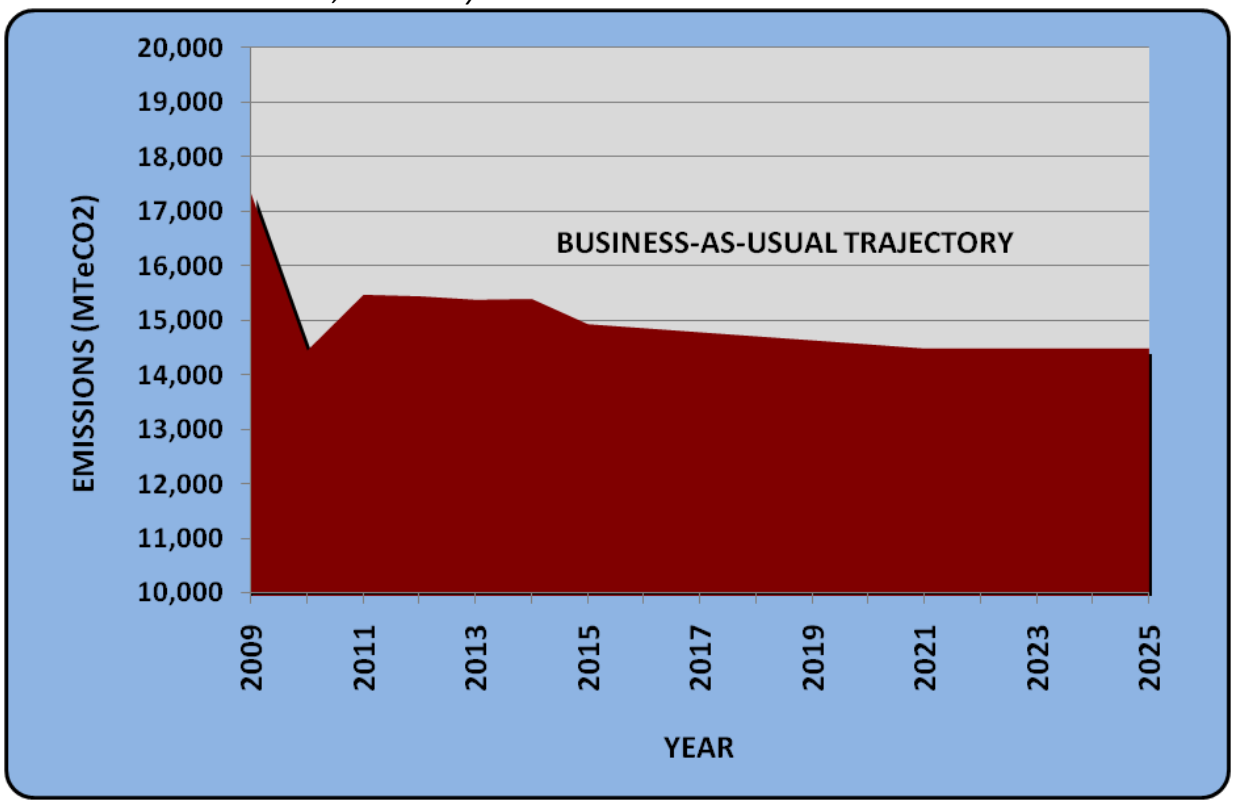


Table 5. *Colgate's estimated emissions under a business-as-usual scenario. This scenario is based on an emissions estimate per FTE while compensating for the new fitness center that went online in 2011 and a 3% per year improvement in automobile fuel efficiency through 2020.*

YEAR	FTE	Emissions per FTE (tons)	Gross Emissions (tons)
2009	2,784	6.23	17,353
2010	2,770	5.24	14,505
2011	2,876	5.39	15,497
2012	2,885	5.36	15,469
2013	2,887	5.34	15,405
2014	2,904	5.31	15,419
2015	2,830	5.28	14,954
2016	2,830	5.26	14,879
2017	2,830	5.23	14,804
2018	2,830	5.20	14,729
2019	2,830	5.18	14,653
2020	2,830	5.15	14,578
2021	2,830	5.12	14,503
2022	2,830	5.12	14,501
2023	2,830	5.12	14,501
2024	2,830	5.12	14,501
2025	2,830	5.12	14,501

4.0 OPERATIONAL PLAN: GOALS AND ACTION STEPS

SUSTAINABILITY AND CLIMATE ACTION PLAN

Remaining flexible and open to new ideas while routinely revising our plan is a key to a successful sustainability program. However, it is also critical to identify specific goals and action steps. This will allow us to stay focused, gauge our progress, and advance with a general sense of direction and purpose. With this in mind, Colgate's Sustainability and Climate Action Plan highlights specific actions to advance sustainability while mitigating greenhouse gas (GHG) emissions.

Each individual project highlighted in this section was analyzed and thoroughly discussed by the Climate Action Plan Steering Committee, members of each of the seven subcommittees, and individuals most directly responsible for the implementation of the project. While this section provides only the "headlines" for each project, it is important to note that we considered (as much as practicable given available time and resources) community and operational impacts, costs, carbon reductions, and overall environmental impacts for each project. In some cases, we lack necessary information to make accurate cost estimates, resource savings, environmental impacts, and estimated greenhouse gas reductions. As a result, the estimates, data, and individual projects listed here lay the groundwork for ongoing discussion and research.

In the end, the Sustainability and Climate Action Plan received endorsement from President Herbst and other members of Colgate's senior administration.

Striving for sustainability is an ongoing process of continuous improvement. We must be willing to refine, replace, and even shelve certain projects in this section when better options arise. Consequently, we will need to reevaluate this operating plan on a regular basis. Table 6 lists all the potential projects organized by fiscal year highlighted in the Sustainability and Climate Action Plan.

Table 6. List of potential projects by implementation year for Colgate's Sustainability and Climate Action Plan.

FISCAL YEAR 2012		
MITIGATION PROJECT		**PROJECT MILESTONE**
4.1.1	Green Office Program (10 new offices; 60 employees)	By 2015, we hope to certify 40 offices influencing the behavior of 240 individuals or 25 percent of Colgate's employees.
4.1.2	Green Living Program (Eco-Olympics & RecycleMania)	By 2015, we hope to influence the behavior of nearly 2,000 residential students or over 70 percent of Colgate's student body.
4.1.3	Green events: waste minimization and recycling	By 2015, all campus events strive to achieve zero waste through careful planning, recycling, and composting.
4.1.6	Campus sustainability awards	Beginning in 2011, we will acknowledge campus leaders in sustainability and turn this into an annual event.
4.2.9	Green building	All new construction and major building renovations strive for LEED Silver standard or equivalent and a 30-40% energy performance improvement over ASHRAE 90.1 2007.
4.4.1	Establish 'reduced mow' areas (20 acres)	By 2013, we have 30 acres of campus grounds designated as "no mow" areas.
4.4.2	Reforestation of open spaces (2 acres)	By 2015, establish 8 acres of campus grounds that are reforested. By 2025, establish a total of 30 acres of campus grounds that are reforested.
4.5.4	$50 minimum purchasing order from Staples and Office Max	By 2012, Colgate establishes a new minimum purchase order of $50 from Staples and Office Max.
4.5.5	Paper purchasing policy (eliminate non-recycled paper)	By 2012, Colgate establishes a new paper purchasing policy that eliminates the purchase of non-recycled (virgin) paper.
4.5.7	Environmentally conscious packaging	In 2012, Colgate continues dialogue with major suppliers expressing our preference to purchase items/produces with environmentally conscious packaging.
4.6.1	Carpooling (12 new carpools)	By 2015, at least 48 new carpools are formed involving 96 employees.
4.6.5	Zipcar service to campus	Beginning in 2012, Colgate has access to two Zipcars on campus.
4.6.9	Biodiesel (B20 blend)	In 2012, Colgate purchases 5,000 gallons of B20 to help fuel our diesel fleet.
4.6.10	Implement 'no-idling' policy	By 2012, Colgate has a campus-wide no-idling policy in place.
4.7.2	Carbon offsets for individual air travel	By 2012, encourage Colgate staff, faculty, and students to explore the option of offsetting their travel by providing reputable options and user-friendly information for offsetting.
4.8.1	On-site composting (pre-consumer)	Pre-consumer composting is implemented in Frank, Merrill House, Coop, and The
4.8.2	Office Swap Program	By 2013, we will have over 100 postings of items to be swapped through the
4.8.3	Establish 0.5" paper margins as campus guideline	In 2012, we promote setting margins at 0.5" and inform employees how to set this as a default at their workstations.
4.8.4	Promote reusable cups during campus events	During 2012, we continue to encourage event planners/organizers to encourage attendees to bring their own cups/mugs instead of providing one-time use disposable cups.
4.8.5	Reduce junk mail	Continue to encourage and help administrative assistants and department managers to reduce unsolicited mail coming to campus.
4.8.6	Encourage paperless courses	Continue to encourage and help professors and educators reduce unnecessary paper use in the classroom.
4.8.7	Madison County landfill tours	Offer annual trips for employees and students to learn about our waste management and recycling practices on campus and in our county.
4.8.8	Reduce bottled water consumption on campus	During 2012, we continue to encourage community members and event planners/organizers to look for other options besides purchasing or providing bottled water.
4.9.1	Low-flow showerheads (first-year housing)	Install low-flow showerheads in first-year housing during the summer of 2011 (FY 2012).

Table 6. Continued

FISCAL YEAR 2013		
MITIGATION PROJECT		**PROJECT MILESTONE**
4.1.1	Green Office Program (10 new offices; 60 employees)	By 2015, we hope to certify 40 offices influencing the behavior of 240 individuals or 25 percent of Colgate's employees.
4.1.2	Green Living Program (first-year housing)	By 2015, we hope to influence the behavior of nearly 2,000 residential students or over 70 percent of Colgate's student body.
4.1.4	Employee training and new employee orientation	By 2013, the Sustainability Office runs a series of annual workshops along two main tracks: 1) Green Office Program Orientation Workshops and 2) Introduction to Sustainability Seminars for staff that explores the concept of sustainability, local food issues, climate change, green cleaning, transportation, and others.
4.1.5	Sustainability in the first-year experience	By 2013, sustainability plays an important and salient role in the First-Year Experience by offering green practices at various orientation events and by offering workshops and presentations during the first weeks of the new academic year.
4.2.5	Sanford Field House (energy conservation measures)	By 2013, Sanford Field House lighting upgrades and controls and unoccupied hours setback have been implemented.
4.2.6	Olin Hall (energy conservation measures)	By 2013, Olin Hall lighting upgrades and controls, unoccupied hours setback, and variable speed drives have been implemented.
4.3.1	Trayless dining operations (Frank Dining Hall)	In 2013, Dining Services implements trayless dining in Frank Dining Hall.
4.3.2	Increase purchase and consumption of local food	By 2015, 30% of Colgate's food purchases come from local sources (within a 250-mile radius).
4.4.1	Establish 'reduced mow' areas (10 acres)	By 2013, we have 30 acres of campus grounds designated as "no mow" areas.
4.4.2	Reforestation of open spaces (2 acres)	By 2015, establish 8 acres of campus grounds that are reforested. By 2025, establish a total of 30 acres of campus grounds that are reforested.
4.4.3	Forest sequestration (carbon accounting project)	In 2013, Colgate begins accounting for annual forest sequestration rates by demonstrating a long-term commitment to forest preservation and by undertaking field measurements using commonly accepted methodologies.
4.4.4	Promote walking at Seven Oaks golf course	In 2013, signage and marketing materials are created to promote walking at Seven Oaks Golf Course.
4.5.1	Environmentally preferrable purchasing policy	By 2013, Colgate has in place an environmentally preferable purchasing policy that encourages employees to consider the environmental and social impacts of our purchasing decisions.
4.5.2	Create vendor code of conduct	By 2013, Colgate has in place a vendor code of conduct that sets expectations that our vendors are to meet minimum standards of environmental and social responsibility.
4.5.3	EPEAT qualified computer and monitor purchasing	By 2013, Colgate has in place an EPEAT preferred purchasing guideline and the campus standard is to purchase EPEAT qualified computers and monitors.
4.5.6	Multi-functional devices	By 2013, Colgate establishes new standard of replacing stand alone devices with MFDs in campus work areas.
4.6.1	Carpooling (12 new carpools)	By 2015, at least 48 new carpools are formed involving 96 employees.
4.6.2	Employee bicycle commuting (10 bikes & 10 bike racks)	By 2015, at least 60 new half-time bicycle commuters are formed.
4.6.3	Student Bicycle Commuting FY 2013 (10 bikes & 10 bike racks)	The number of students who commute by bicycle is up from 10% in 2010 to 15% in 2015.
4.6.7	Purchase electric vehicles (2)	By 2015, six electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.
4.6.8	Purchase hybrid-electric vehicle (1)	By 2015, three hybrid-electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.
4.8.1	On-site composting (post-consumer)	Post-consumer composting is implemented in Frank, Merrill House, Coop, and The Edge.
4.9.1	Low-flow showerheads (second-year housing)	Install low-flow showerheads in second-year housing during the summer of 2012 (FY 2013).
4.9.2	Reduce watering of artificial turf	By 2013, we will save money and water by reducing the unnecessary watering of turf at Tyler's Field.

Table 6. Continued

FISCAL YEAR 2014		
MITIGATION PROJECT		**PROJECT MILESTONE**
4.1.1	Green Office Program (10 new offices; 60 employees)	By 2015, we hope to certify 40 offices influencing the behavior of 240 individuals or 25 percent of Colgate's employees.
4.1.2	Green Living Program (Second-Year Housing)	By 2015, we hope to influence the behavior of nearly 2,000 residential students or over 70 percent of Colgate's student body.
4.2.1	Fuel switching: eliminate fuel oil #6	By 2014, replace fuel oil burners with natural gas and complete fuel switch.
4.2.3	Solar thermal energy	By 2014, a solar thermal system is installed and in use at 100 Broad Street (Creative Arts House) or other feasible location.
4.2.7	McGregory Hall (energy conservation measures)	By 2014, McGregory Hall lighting upgrades and controls and unoccupied hours setback have been implemented.
4.2.8	Adaptive computer power management	By 2014, Colgate utilizes adaptive power management software that will automatically power-down networked computers when not in use.
4.4.2	Reforestation of open spaces (2 acres)	By 2015, establish 8 acres of campus grounds that are reforested. By 2025, establish a total of 30 acres of campus grounds that are reforested.
4.6.1	Carpooling (12 new carpools)	By 2015, at least 48 new carpools are formed involving 96 employees.
4.6.2	Employee bicycle commuting (10 new bikes)	By 2015, at least 60 new half-time bicycle commuters are formed.
4.6.3	Student bicycle commuting (10 new bikes)	The number of students who commute by bicycle is up from 10% in 2010 to 15% in 2015.
4.6.4	Encourage flexible working schedules	By 2014, 10% of Colgate employees incorporate flexible work hours into their work schedule.
4.6.7	Purchase electric vehicles (2)	By 2015, six electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.
4.6.8	Purchase hybrid-electric vehicle (1)	By 2015, three hybrid-electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.
4.7.1	Video and teleconferencing	By 2014, Colgate staff, faculty, and students significantly increase the use of video conferencing technologies to connect with colleagues and peers at other

FISCAL YEAR 2015		
MITIGATION PROJECT		**PROJECT MILESTONE**
4.1.1	Green Office Program (10 new offices; 60 employees)	By 2015, we hope to certify 40 offices influencing the behavior of 240 individuals or 25 percent of Colgate's employees.
4.1.2	Green Living Program (townhouses and apartments)	By 2015, we hope to influence the behavior of nearly 2,000 residential students or over 70 percent of Colgate's student body.
4.2.2	Wind energy	By 2015, wind energy is installed on campus.
4.2.4	Geothermal heat exchange	By 2015, a geothermal heat pump is installed and in use at Chapel House or other feasible location.
4.4.2	Reforestation of open spaces (2 acres)	By 2015, establish 8 acres of campus grounds that are reforested. By 2025, establish a total of 30 acres of campus grounds that are reforested.
4.6.1	Carpooling (12 new carpools)	By 2015, at least 48 new carpools are formed involving 96 employees.
4.6.2	Employee bicycle commuting (10 new bikes)	By 2015, at least 60 new half-time bicycle commuters are formed.
4.6.3	Student bicycle commuting (10 new bikes)	The number of students who commute by bicycle is up from 10% in 2010 to 15% in 2015.
4.6.6	Group purchasing for fuel efficient vehicles	By 2015, Colgate offers employee purchasing discounts for fuel efficient vehicles.
4.6.7	Purchase electric vehicles (2)	By 2015, six electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.
4.6.8	Purchase hybrid-electric vehicle (1)	By 2015, three hybrid-electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.

4.1 BEHAVIOR CHANGE AND CAMPUS CULTURE

At Colgate, we recognize that behavior change can be the most cost-effective way to advance sustainability on campus while reducing our greenhouse gas emissions. If every employee and student considered sustainability when making daily decisions, then progress would occur in pervasive and substantial ways. Moreover, with no large capital costs and few technological barriers to overcome, behavior-change programs and their impacts can be implemented immediately and serve as a gateway to community engagement and achievement of longer-term goals. Quantifying resource conservation, energy reduction, and carbon emissions associated with behavior-change programs is difficult. For this reason, we erred on the side of caution and used conservative estimates for each of our behavior-change projects.

Current Practices and Recent Accomplishments

Over the past few years, the Colgate community has made great strides in raising its knowledge, awareness, and practice of campus sustainability. Colgate's Campus Ecology Group, established in 1997, is the university's longest standing environmental sustainability committee. Today, the Campus Ecology Group serves as a clearinghouse of information, a sounding board for new ideas, and a platform for project updates helping to keep campus sustainability objectives alive throughout the academic year. Other committees such as Colgate's Sustainability Council and the Climate Action Plan Subcommittees involve dozens of faculty, staff, and students in the planning process of creating a culture of sustainability at Colgate. Annual events such as the Green Summit, 13 Days of Green, National Teach-in, PowerShift, Focus the Nation, Earth Day, Colgate's Eco-Olympics, the Green Careers Forum, and RecycleMania cast a wide net involving hundreds of students on campus. With over 10 student groups (representing over 100 students) dedicated to sustainability, an informational website, social media, a sustainability pledge, and the Green Office Program, the awareness of campus sustainability is greater now than at any point in Colgate's history.

4.1.1 Green Office Program

Created in 2009 by a group of faculty and staff, the Green Office Program[11] is intended to foster sustainable behavior in the workplace by providing educational resources, generating excitement, and raising awareness around issues of sustainability in the work environment. At the heart of the Green Office Program is a checklist of green practices that if implemented would reduce Colgate's ecological and carbon footprints.

Milestone:
By 2015, we hope to certify 40 offices influencing the behavior of 240 individuals or 25 percent of Colgate's employees.

Metrics and Timeline:
Register and certify 10 green offices per year for a total of 40 offices or 240 employees by the end of Fiscal Year 2015.

Recommended Action:

1. Reach out to administrative assistants and other employees through workshops and office meetings to introduce the Green Office Program and encourage teams to sign up.
2. Continue exploring creative ways to encourage participation.
3. Continue publishing monthly "Green Tip of the Month" information sheet.

Lead Responsibility:
Sustainability Office

[11] Colgate's Green Office Program can be viewed online at: http://www.colgate.edu/about/sustainability/greencampusinitiative/greenofficeprogram.

Table 7. *Green Office Program financial analysis and cost savings per MTeCO2 reduced between FY 2012 and FY 2015.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Green Office Program FY 2012 (10 new offices; 60 employees)	$ -	$ 2,000	$ (27,500)	$ (25,500)	$ (127,500)	0.1	47	$ (2,713)
Green Office Program FY 2013 (10 new offices; 60 employees)	$ -	$ -	$ (27,500)	$ (27,500)	$ (137,500)	0.0	47	$ (2,926)
Green Office Program FY 2014 (10 new offices; 60 employees)	$ -	$ -	$ (27,500)	$ (27,500)	$ (137,500)	0.0	47	$ (2,926)
Green Office Program FY 2015 (10 new offices; 60 employees)	$ -	$ -	$ (27,500)	$ (27,500)	$ (137,500)	0.0	47	$ (2,926)
TOTALS	**$ -**	**$ 2,000**	**$ (110,000)**	**$ (108,000)**	**$ (540,000)**	**0.0**	**188**	**$ (2,872)**

4.1.2 Green Living Program

Created by student interns and volunteers in collaboration with the Sustainability Office, the Green Living Program[12] is intended to foster sustainable behavior among Colgate's residential students. By implementing a series of green practices, students can promote environmentally friendly behaviors that ultimately reduce Colgate's ecological and carbon footprints. Also at the heart of the Green Living Program are annual energy/water saving and recycling competitions such as the Eco-Olympics and RecycleMania, respectively. These annual competitions are made possible by utilizing an online building dashboard that tracks real-time energy use in first and second-year housing. Together, these programs promote green living on the Colgate campus.

Milestone:

By 2015, we hope to influence the behavior of nearly 2,000 residential students or over 70 percent of Colgate's student body.

Metrics and Timeline:

- FY 2012: Student intern helps to develop educational program and overall plan.
- FY 2013: Implement the Green Living Program in first-year housing (Andrews, Curtis, East, Gate House, Stillman, and West). Install building dashboard energy monitoring system in first-year housing.
- FY 2014: Implement the Green Living Program in second-year housing (Bryan Complex, Cutten Complex, and Drake). Install building dashboard energy monitoring system in second-year housing.
- FY 2015: Implement the Green Living Program in junior and senior housing (Newell, Parker, University Court, and Townhouses).

Recommended Action:

1. Establish Eco-Rep training program that facilitates student ambassadors for sustainability on campus.
2. Hire student interns to help research, promote, and implement programs in specific living areas.
3. Install building dashboard energy monitoring system in first-year housing in FY 2013 and in second-year housing in 2014.
4. Establish Eco-Olympics and RecycleMania as annual spring semester events with broad awareness and participation.

Lead Responsibility:

Sustainability Office; ITS; Manager of Engineering Services.

[12] Colgate's Green Living Program can be viewed online at: http://www.colgate.edu/about/sustainability/greencampusinitiative/residentialgreenliving.

Table 8. *Green Living Program financial analysis between FY 2012 and FY 2015.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Green Living Program FY 2012 (Eco-Olympics & RecycleMania)	$ -	$ 4,100	$ (5,800)	$ (1,700)	$ (8,500)	0.7	21	$ (407)
Green Living Program FY 2013 (Andrews, Curtis, East, Gate House, Stillman, West)	$ 29,800	$ 23,200	$ (36,900)	$ 16,100	$ (38,700)	1.4	109	$ (357)
Green Living Program FY 2014 (Bryan Complex, Cutten Complex, Drake)	$ 8,500	$ 13,200	$ (36,500)	$ (14,800)	$ (108,000)	0.6	112	$ (968)
Green Living Program FY 2015 (Newell, Parker, University Court, Townhouses)	$ -	$ 14,200	$ (25,500)	$ (11,300)	$ (56,500)	0.6	34	$ (1,664)
TOTALS	**$ 38,300**	**$ 54,700**	**$ (104,700)**	**$ (11,700)**	**$ (211,700)**	**0.9**	**276**	**$ (767)**

4.1.3 Green events: waste minimization and recycling

Campus events provide a great opportunity to introduce and engage community members to the principles and practices of sustainability. Some events such as Reunion, Convocation, graduation, home athletic events, lectures, and ceremonies attract hundreds and sometimes thousands of participants. Promoting green practices during these events can result in significant reductions in landfill waste, energy use, and greenhouse gas emissions.

Current practices and recent accomplishments:

A number of campus organizers are taking measures to reduce waste and promote sustainability at their events. A few recent examples include:

- Environmental Studies Brown Bag Lunch Series which serves local and organic foods and eliminates waste through composting and recycling.
- Sporting events such as home football and hockey games now include recycling bins. Student environmentalists promote recycling by attending games and encouraging tailgaters and fans to recycle.
- The annual Tu B'shvat celebration at the Sapperstein Jewish Center composts all food waste and eliminates most disposable items.
- Faculty Sustainability Tunk which serves local and local/organic foods.
- Students of Environmental Action (SEA) host an annual local-foods dinner.
- Reunion incorporates local food options, composting, recycling, biodegradable/compostable dinnerware, carpooling, energy savings, and offset options into each year's Reunion College.

Milestone:

By 2015, all campus events strive to achieve zero waste through careful planning, recycling, and composting. Organizers will incorporate other green practices such as serving local and/or organic foods when possible, carbon offsetting, and utilizing environmentally friendly products. Table 9 highlights green practices that event organizers should consider when planning for and hosting an event.

Table 9. *Basic options for incorporating green practices into all campus events.*

EVENT PROMOTION/ADVERTISING	
☐	**Send invitations electronically to reduce paper consumption.**
☐	**Print programs on post-consumer, recycled paper.**
☐	**Market event electronically or on post-consumer, recycled paper.**
FOOD & DINING OPTIONS	
☐	**Offer organic and/or local food.**
☐	**Encourage right-sized portions.**
☐	**Use washable/reusable plates, cups, utensils.**
☐	**Use compostable/biodegradable plates, cups, utensils if reusable is not an option. Avoid Styrofoam, paper, or plastic.**
☐	**Encourage attendees to bring their own cup, mug, or refillable water container.**
☐	**Use napkins that contain 100 percent post-consumer content.**
TRANSPORTATION	
☐	**Encourage alternative transportation options (e.g., carpooling, train, boat, bus) rather than driving alone or flying to campus events.**
☐	**Encourage alternative transportation options (e.g., Cruiser, carpooling, biking, walking) for on-campus travel during the event.**
☐	**Provide or promote options to offset travel (e.g., Patagonia Sur).**

Metrics and Timeline:
By 2012, all campus events include conveniently placed and highly visible recycling containers. In 2012, composting at events continues at Reunion 2012 and other select campus events. This program is expanded annually to include other venues around campus.

Recommended Action:

1. Organizers plan for zero-waste (or near zero-waste) events where disposable, one-time use items are avoided.
2. Provide recycling bins and clear signage as part of the standard setup for all campus events.
3. Compost food items at select campus events. Expand this program yearly for four years.

Lead Responsibility:
Event coordinators/organizers, B&G setup crews, and Sodexo staff in collaboration with the Sustainability Office.

Table 10. *Green event planning financial analysis between FY 2012 and FY 2015.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Green events: waste minimization & recycling	$ -	$ -	$ (600)	$ (600)	$ (3,000)	0.0	2	$ (1,500)

4.1.4 Employee training and new employee orientation

Working with staff and introducing new employees to the goals, practices, and concepts of sustainability at Colgate is an ideal way to encourage sustainable behavior on campus. This initiative looks to create workshops and educational material that introduces and engages new employees in our sustainability program.

Current practices and recent accomplishments:
Human Resources has been working with the Sustainability Office to introduce staff to the sustainability goals and practices at Colgate. The Sustainability Office contributes regular articles in the monthly faculty and staff newsletter, *The Open 'Gate*. The Sustainability Office also runs periodic workshops introducing individuals to the Green Office Program and encouraging participation. Additionally, the Sustainability Coordinator introduces sustainability to new employees during new employee orientation. This is all done in a manner to promote better business practices that advance sustainability in the workplace.

Milestone:
By 2013, the Sustainability Office runs a series of annual workshops along two main tracks: 1) Green Office Program Orientation Workshops and 2) Introduction to Sustainability Seminars for staff that explores the concept of sustainability, local food issues, climate change, green cleaning, transportation, and others.

Metrics and Timeline:

- By 2013, the Sustainability Office reaches each new employee offering guidance and educational opportunities to learn about Colgate's sustainability program and values.
- Starting in 2013, the Sustainability Office launches its seminar series in sustainability with the goal of having at least 10 employees registered.

Recommended Action:

- The Sustainability Office continues offering Green Office Orientation Workshops and new employee orientation presentations.
- Starting in 2012, the Sustainability Office runs at least three Green Office Orientation Workshops annually.
- By 2013, the Sustainability Office creates and begins hosting Introduction to Sustainability Seminars.

Lead Responsibility:
Sustainability Office.

4.1.5 Sustainability in the first-year experience

A Colgate student's first semester on campus is the ideal time to introduce him or her to the principles and practices of sustainability. This initiative looks to create workshops and educational material that introduces and engages new students in our sustainability program.

Current practices and recent accomplishments:
Over the past few years, the Sustainability Office has partnered with Green Summit students, the dean of first-year students, residential life, and the LOFT program to raise awareness, inspire, and empower students early in their Colgate experience to embrace sustainability goals and practices.

- In a partnership between the Sustainability Office and dean of first-year students, Colgate provides reusable tote bags that highlight our green initiatives on campus and introduced students to the value of avoiding plastic bags.
- The Sustainability Office and Green Summit students work with the Links and residential advisers during their training programs to promote the practice of recycling and sustainability in their residence halls.
- The Sustainability Office provides a sustainability flyer that is placed in student's orientation packet.
- Leadership Options for Tomorrow (LOFT) is a program designed for first-year students who are coming to college with some basic leadership training and are planning to assume leadership positions at Colgate. The Sustainability Office offers a leadership track that introduces students to sustainability at Colgate while exploring ways that LOFT students can be environmental leaders on campus.

Milestone:
By 2013, sustainability plays a salient role in the First-Year Experience by offering green practices at various orientation events and by offering workshops and presentations during the first weeks of the new academic year.

Metrics and Timeline:
- Reusable tote bags are offered to each incoming student annually.
- Every incoming student receives an `introduction to sustainability' flyer in their orientation material that also highlights ways individuals can get involved.
- The Sustainability Office continues to work with students to develop Link and RA training materials.
- The Sustainability Office continues to provide a LOFT track that further develops student leaders in sustainability.

Recommended Action:
- The Sustainability Office continues to work with the dean of first-year students and the director of residential life to explore options to increase the presence of sustainability in the First-Year Experience.
- The sustainability coordinator continues to work with student interns and staff to offer and improve orientation and training materials that impact first-year students.

Lead Responsibility:
Dean of first-year students, director of residential life, senior assistant director of residential life, and sustainability coordinator.

4.1.6 Campus sustainability awards

Host an annual awards ceremony to celebrate outstanding individual or group achievements in sustainability. These awards can be incorporated into the annual Green Summit or as part of a more formal awards ceremony on campus.

Milestone:
Beginning in 2011, we will acknowledge campus leaders in sustainability and turn this into an annual event.

Recommended Action:
Develop criteria and venue for awards.

Lead Responsibility:
Sustainability Council, Sustainability Office.

4.2 ENERGY AND BUILDINGS

Colgate University has 160 buildings encompassing over 2.3 million square-feet of floor space. Providing energy to these buildings consumes as much as 80% of the electrical and fuel oil use on campus and is responsible for 46% of the university's gross greenhouse gas emissions (Figure 2). In 2009, Colgate spent over $4.6 million in energy and water consumption (Table 1). For these reasons, how we construct, renovate, and operate our buildings has significant

impacts on our energy use, budget, and ecological and carbon footprints and, therefore, must be an essential component of Colgate's Sustainability and Climate Action Plan.

Current practices and recent accomplishments:
Compared to many other colleges and universities, Colgate has relatively low Scope 1 and Scope 2 emissions. Since 1981, Colgate's primary source of heating and domestic hot water comes from the campus 900 Boiler horsepower (BoHP) wood chip boiler which—according to international protocol and the guidelines established by the ACUPCC—does not contribute to the campus carbon footprint. According to Colgate's baseline greenhouse gas inventory for 2009, the greenhouse gas emissions associated with Colgate's secondary fuels (fuel oil #6 and fuel oil #2) combined for a total 6,232 MTeCO2 (Figure 1)—a relatively low number for these Scope 1 emissions associated with providing heat and hot water to campus.

Likewise, Colgate's Scope 2 emissions—associated with purchased electricity through its agreement with the Village of Hamilton municipal electric utility—totaled 1,885 MTeCO2 in 2009. These emissions are also low compared with the national and New York averages, because 84% of the electrical mix comes from non-carbon–emitting hydroelectric power.

Energy Supply and On-Campus Production

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. The heating plant was constructed in 1907 as a coal-fired plant. It was converted to heavy fuel oil #6 in 1966. In 1981, a wood chip-burning boiler addition was constructed. Although the wood firing capacity at Colgate is only about 40% 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% of its annual heating requirement from wood combustion. The remaining steam is generated with fuel oil #6 in two water tube boilers installed in 1966 and one fire tube boiler installed in 1987. The two older boilers have exceeded their expected life of 40 years and the newer boiler will reach its expected life of 25 years in 2012. Additionally, the main heating plant layout, ancillary systems, and equipment have not been upgraded, with the exception of the wood boiler system in 1981, in 45 years. Many safety, functional, and efficiency issues exist.

Important decisions regarding Colgate's energy future are imminent regardless of the university's sustainability and climate action planning efforts. The impending heating plant upgrade presents an opportunity to switch from expensive and carbon-intensive heavy fuel oil #6 to a form of energy that is cost-effective and low-carbon.

Due to the technical complexity of the decision-making process, high cost, and long range impact of determining the future of Colgate's energy future, a team of technical experts with whom Colgate has considerable work experience was assembled to undertake the task of conducting a heating plant-upgrade feasibility study. The team included:

- Peterson Guadagnolo Engineers, PC (lead firm)
- Combustion Designs, Inc. (major equipment)
- Buck Engineering (environmental and permitting)
- Klepper, Hahn & Hyatt, PC (structural and civil engineering)
- Peter Babich (Colgate associate director of facilities and manager of engineering services)
- Paul Fick (Colgate associate vice president for facilities)

As a result of this work, switching from fuel oil #6 to natural gas (project 4.2.1; described in more detail below) emerged as the most likely scenario.

4.2.1 Fuel Switching: eliminate fuel oil #6

Colgate is currently allowed to burn high sulfur fuel oil #6 in boilers #1, #2, and #3 under a "grandfathered" New York State DEC air permit. Replacement of these boilers requires the university to reapply for a new air permit and meet

current stack discharge cleanliness standards. These standards do not allow for combustion of high sulfur fuel oil #6. This forces the university to change to an alternate fuel. Practical options include fuel oil #2 and (potentially) natural gas. Use of vegetable oil in a smaller "#3 boiler," although desirable relative to its inherent zero carbon-emission rating, was determined to be not feasible due to the following financial factors:

- Vegetable oil's significantly higher cost relative to natural gas.
- Cost of required preheating prior to use.
- Cost of required separate tank storage and handling systems.
- Requirement for replacement of existing boiler #3 at a cost of approximately one million dollars above and beyond the proposed cost of the recommended two new natural gas-fired boilers scenario.

Expansion of wood chip steam generating capacity is deemed not feasible at this time due to first cost, wood chip supply and future cost uncertainties, and potential plant expansion and material handling space limitations.

While not a certainty at this time, it appears likely that Colgate will have access to natural gas in the near future via an ongoing Village of Hamilton initiative to bring natural gas to the area. If natural gas turns out not to be available, the wood option should be studied to compare wood chip plant-expansion cost, wood chip-supply chain reliability, site limitations, and inherent material handling logistics issues with the increased cost of utilizing fuel oil #2.

Crude oil is expected to increase in cost by an average of 4.43% per year from $75.52 per barrel in 2010 to $182.35 per barrel in 2035.[13] Natural gas is also predicted to increase in price but at the slower rate of 4.19% per year from $4.47 per MMBtu in 2010 to $11.50 per MMBtu in 2035.[14] Wood chips are the most cost-effective and potentially climate-friendly way to provide energy to campus and will remain the primary source of energy for Colgate under any scenario.

Table 11 compares fuel cost options between Colgate's existing system, a natural gas scenario, and a new system that utilizes fuel oil #2. The natural gas scenario is the preferred option to fuel oil #2 and represents the greatest return on investment (ROI) at 3.77% and a $366,000 savings in annual fuel costs.

Table 11. *Comparison of fuel stock cost options and associated emissions comparing Colgate's existing heating plant configuration vs. natural gas vs. fuel oil #2.*

PLANT CONFIGURATION	EXISTING SYSTEM	NATURAL GAS (preferred option)	FUEL OIL #2 (no natural gas)
Wood Boiler	26,500 lbs/hr	26,500 lbs/hr	26,500 lbs/hr
Fossil Fuel Boiler #1	40,000 lbs/hr	60,000 lbs/hr	60,000 lbs/hr
Fossil Fuel Boiler #2	40,000 lbs/hr	60,000 lbs/hr	60,000 lbs/hr
Fossil Fuel Boiler #3	20,700 lbs/hr	---	---
Sulphur Dioxide (SO2) Emissions (tons)	39	---	---
Carbon Dioxide (CO2) Emissions (tons)	4,384	2,823	3,714
First Cost	$ -	$ 7,300,000	$ 7,400,000
Annual Fossil Fuel Cost	$ 788,000	$ 422,000	$ 948,000
Annual Fuel Cost Savings	---	$ (366,000)	$ 160,000
Return on Investment (ROI)	---	3.77%	No Return

[13] Forecasting information obtained from the Energy Information Administration (EIA) Annual Energy Outlook, 2011: http://www.eia.doe.gov/oiaf/aeo/tablebrowser/.
[14] Ibid.

This project would continue operation of the wood boiler as the "lead" steam producer, upgrade of its emissions monitoring and fuel-feed systems, replacement of the existing fuel oil #6 boilers with new boilers capable of firing either fuel oil #2 or natural gas (preferred option), and providing plant operational, metering, and control improvements.

Milestone:

- In 2014, two new water tube boilers sized at 60,000 lbs/hr, replace existing fuel oil #6 boilers.[15]

Metrics and Timeline:

- In 2014, two new 60,000 lbs/hr natural gas ready boilers are installed in the heating plant. This saves the university between $275,800 to $366,000 per year in fuel costs and reduces our gross greenhouse gas emissions by 1,258 MTeCO2.

Recommended Action:

The Heating Plant Upgrade Feasibility Study recommended the following:

- Continued operation of the wood boiler as "lead" steam generator.
- Replace existing boilers #1 and #2 (fuel oil #6 fired) with new boilers capable of firing both natural gas and fuel oil #2 with natural gas a primary fuel and fuel oil #2 as a backup fuel (**"preferred option"**).
- Eliminate boiler #3 (fuel oil #6 fired).

Lead Responsibility:

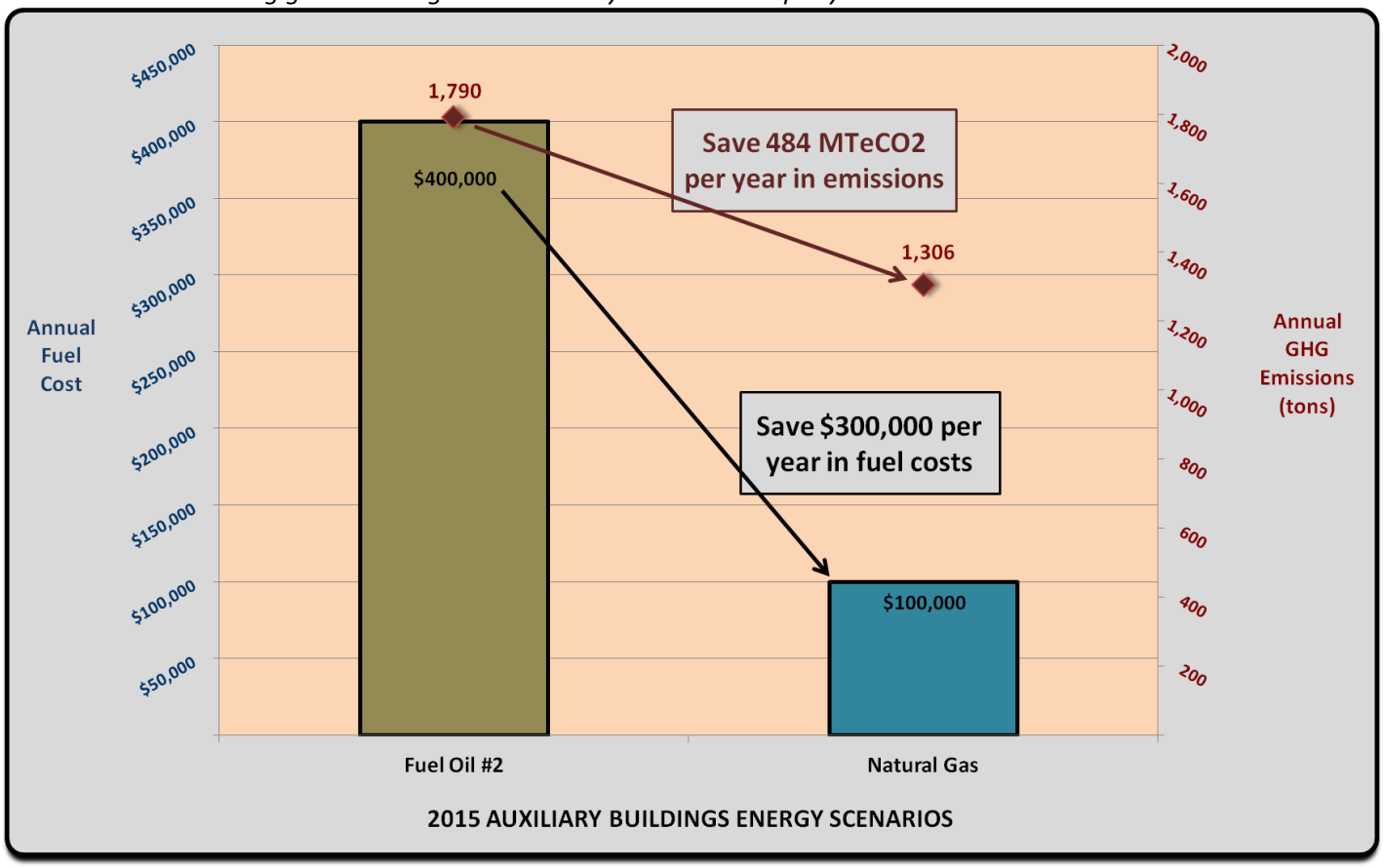
Associate vice president for facilities.

It is important to note that Colgate's annual energy costs would increase by $1.5 million and greenhouse gas emissions would increase by 17,000 MTeCO2—to a total of over 31,000 MTeCO2—if natural gas replaced wood and fuel oil in our Central Plant. For these reasons, relying primarily or entirely upon natural gas was not considered as an option for our energy future.

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. In 2010, Colgate used 174,400 gallons to heat this space which cost $400,000 and emitted 1,752 tons of greenhouse gases. In 2010, we experimented with heating 70 Broad Street (The Loj) with vegetable oil (replacing fuel oil #2). The experiment failed as we experienced numerous maintenance problems and were never able to keep the burner running consistently. In the short term, we have few solutions to address the heating needs and greenhouse gas emissions associated with Colgate's auxiliary buildings. However, the Village of Hamilton appears to be moving forward with bringing natural gas to the area as a viable option. Figure 4 illustrates the annual fuel savings and greenhouse gas reductions *if* Colgate is able to replace fuel oil #2 with natural gas.

[15] It is important to note that the actual implementation date is contingent on whether natural gas comes to the Village.

Figure 4. *Hypothetical scenario where natural gas replaces fuel oil #2 for Colgate's auxiliary buildings that are not connected to the steam line from the Central Utility Plant. Under this scenario, Colgate would save $300,000 per year in fuel costs while reducing greenhouse gas emissions by 484 MTeCO2 per year.*



Renewable energy technologies including wind energy (4.2.2), solar thermal energy (4.2.3), and geothermal heat exchange (4.2.4)

We also considered emerging and renewable energy technologies as part of a diversified portfolio of greenhouse gas reduction projects. O'Brien & Gere completed a screening-level evaluation of a number of these technologies, including wind energy (Bewkes), solar thermal energy (100 Broad Street), and geothermal heat exchange (Chapel House)—projects 4.2.2, 4.2.3, and 4.2.4, respectively. Electrical and thermal loads, site configuration, site location issues, and general sizing issues were used in evaluating the viability of each type of technology considered. Table 12 provides a snapshot evaluation of these projects.

Table 12. *Potential renewable energy technologies for Colgate's energy future and associated financial and greenhouse gas emissions impacts.*

	SCOPE 1	SCOPE 2				
RENEWABLE ENERGY PROJECTS	ANNUAL FUEL SAVINGS (gallons)	ANNUAL ELECTRICAL SAVINGS (kWh)	ANNUAL ENERGY COST SAVINGS ($)	CAPITAL COST ($)	SIMPLE PAYBACK (Years)	ANNUAL GHG REDUCTION (MTeCO2)
Wind energy (Bewkes Cottage)	-	(27,700)	$ (3,200)	$ 86,000	35.7	2
Solar thermal energy (100 Broad Street)	(600)	400	$ (1,400)	$ 27,500	19.6	6
Geothermal heat exchange (Chapel House)	(7,200)	42,600	$ (14,600)	$ 125,000	8.6	70
TOTAL	**(7,800)**	**15,300**	**$ (19,200)**	**$238,500**	**12**	**78**

Energy conservation measures (ECMs) in Sanford Field House (4.2.5), Olin Hall (4.2.6), and McGregory Hall (4.2.7)

Colgate selected the following facilities to be the focus of a campus energy assessment conducted by engineering firm O'Brien & Gere[16] in 2010 as a representative sample of the various building types on campus:

- Central Heating and Cooling Plant
- Curtis Hall, McGregory Hall, Olin Hall
- Sanford Field House

The combined floor area of these buildings is 316,000 gross square feet, representing 13% of the campus building portfolio. While O'Brien & Gere's energy assessment was not comprehensive, it provided Colgate with a snapshot of potential campus-wide mitigation strategies and gave us insight into the potential energy savings we may be able to achieve in the years ahead. The results of O'Brien & Gere's energy assessment coupled with the expertise of Colgate's Buildings and Grounds staff provide an important source of information, data, and forecasting for this section.

The energy conservation measures highlighted in this section have a low- to moderate-level of capital investment, a relatively low return on investment (ROI), and will generate energy savings and greenhouse gas emission reductions that can be measured and maintained to demonstrate Colgate's progress in meeting the goals of the ACUPCC.

Current practices and recent accomplishments:

While Colgate's energy supply has low carbon intensity, we have also made recent strides in using our energy more efficiently and conservatively. From FY 2009 to 2010, Colgate reduced its consumption of electricity, fuel oil #6, and fuel oil #2 (Table 13). This saved the university $676,589 in energy costs and reduced our GHG footprint by 1,219 MTeCO2.

[16] O'Brien & Gere website: http://www.obg.com/

Table 13. *Utility costs and GHG emissions, 2009 vs. 2010.*

UTILITY COSTS AND GHG EMISSIONS, 2009 & 2010										
COLGATE UTILITY	FY 2009				FY 2010				Cost Savings	GHG Reductions
	Quantity	Unit Cost	Total Cost	GHG Emissions	Quantity	Unit Cost	Total Cost	GHG Emissions		
Electricity (kWh)	31,571,030	$ 0.045	$ 1,420,696	1,885	30,264,128	$ 0.045	$ 1,361,886	1,807	$ (58,811)	78
Wood Chips (tons)	22,249	$ 40.00	$ 889,960	-	23,898	$ 40.00	$ 955,920	-	$ 65,960	-
Fuel Oil #6 (gallons)	371,457	$ 2.24	$ 832,064	4,368	283,974	$ 1.39	$ 394,724	3,339	$ (437,340)	1,029
Fuel Oil #2 (gallons)	185,503	$ 3.50	$ 649,261	1,864	174,399	$ 2.31	$ 402,862	1,752	$ (246,399)	112
TOTAL			$ 3,791,981	8,117			$ 3,115,391	6,898	$ (676,589)	1,219

A few of our ongoing efforts that have led to this savings include:

- Replacement of incandescent light bulbs with compact fluorescent bulbs (CFLs). Colgate purchased over 2,000 CFLs from the local Hamilton School Boosters Club.
- Replacement of all T-12 fluorescent light bulbs with higher efficiency T-8 and T-5 fluorescent bulbs.
- Replacement of existing fluorescent light fixture ballasts with high efficiency electronic ballasts.
- Ongoing program to increase the efficiency of the 28-year-old wood chip boiler through a combination of state-of-the-art controls and improved operating procedures. Our wood boiler is currently achieving 79% efficiency (large gas and oil boilers typically exhibit efficiencies from 75 to 80% and typical wood boilers around 70%).
- Campus underground chilled water distribution piping system was expanded to facilitate future use of chilled water in buildings currently utilizing multiple unitary air conditioning units (window units) for summer cooling, reducing cooling electric energy consumption from approximately 1.2 KW/ton to below 0.75 KW/ton.
- Ongoing program to identify and replace underground steam and condensate piping which has experienced insulation jacket failure, voiding the insulating value of the original pipe insulation and creating excessive energy losses in the piping systems.
- Completing installation of a $500,000 utility data acquisition system serving all major campus buildings and providing real-time telemetry on steam consumption, domestic water use, electric energy use, and chilled water use. This system allows us to detect and remedy energy waste and inefficiencies.
- Ongoing program utilizing data from the campus energy management and utility data acquisition systems to identify high energy use buildings and systems and reduce energy demand through modification and optimization of control schemes, occupancy control schedules, temperature set back, and outdoor air ventilation systems management.

Project Description:

We considered potential energy conservation measures and efficiency projects in one athletic building (Sanford Field House), one academic/administrative building (McGregory Hall), and one research building (Olin Hall) as a sample of the types of projects we could extrapolate from and perform throughout campus. For Sanford, McGregory, and Olin, we completed an evaluation of several conservation and efficiency projects including:

- lighting upgrades, occupancy sensors, and unoccupied hours setback in Sanford Field House
- lighting upgrades, occupancy sensors, unoccupied hours setback, and variable speed drives in Olin Hall
- lighting upgrades, occupancy sensors, and unoccupied hours setback in McGregory Hall

Milestone:

- In 2013, **Sanford Field House** and **Olin Hall** energy conservation measures are implemented.
- In 2014, **McGregory Hall** energy conservation measures are implemented.

Metrics and Timeline:

- In 2013, **Sanford Field House** energy conservations measures are implemented saving $25,600 in annual operating costs while reducing our total campus carbon footprint by 35 MTeCO2.
  - Electricity consumption in Sanford Field House is reduced by 593,450 kWh during Fiscal Year 2013 compared to the baseline in 2010.
- In 2013, **Olin Hall** energy conservation measures are implemented saving $34,700 in annual operating costs while reducing our total campus carbon footprint by 92 MTeCO2.
  - Electricity consumption in Olin Hall is reduced by 310,799 kWh during Fiscal Year 2013 compared to the baseline in 2010.
- In 2014, **McGregory Hall** energy conservation measures are implemented saving $21,500 in annual operating costs while reducing our total campus carbon footprint by 60 MTeCO2.
  - Electricity consumption in McGregory Hall is reduced by 155,204 kWh during Fiscal Year 2014 compared to the baseline in 2010.

Recommended Action:

Sanford Field House

1. The lighting fixtures should be replaced with high output linear fluorescent fixtures. Each new fixture would contain four T-5 lamps.
2. Install occupancy sensors allowing for separate illumination of each tennis court and the running track.
3. Lower the set-point for heating (setback) during unoccupied times. Night Operation cycles the HVAC equipment during unoccupied periods to maintain conditions that reduce energy usage, while protecting the facility from temperature-related damage.

Olin Hall

1. Replace current lighting fixtures (T-12) with energy-saving fixtures (T-8).
2. Where appropriate, reduce the number of lamps per fixture. In most cases where there are multiple lamps per fixture, one lamp would suffice.
3. Install occupancy sensors in all rooms and corridors.
4. Establish unoccupied hours setback.
5. Install variable speed drives on motors lacking drives and on motors with outdated and/or malfunctioning drives. This will require installing new motors, which is included in the cost estimation.

McGregory Hall

1. Replace current lighting fixtures (T-12) with energy-saving fixtures (T-8).
2. Where appropriate, reduce the number of lamps per fixture. In most cases where there are multiple lamps per fixture, one lamp would suffice.
3. Install occupancy sensors in all rooms and corridors.
4. Establish unoccupied hours setback.

Lead Responsibility:

Associate vice president for facilities.

Table 14. *Energy conservation measures in select buildings (Sanford Field House, Olin Hall, McGregory Hall) with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Sanford lighting fixtures and controls	$ 60,000	$ -	$ (19,700)	$ 40,300	$ (38,500)	3.0	10	$ (4,053)
Sanford unoccupied hours setback	$ 4,500	$ -	$ (5,900)	$ (1,400)	$ (25,000)	0.8	26	$ (973)
Olin lighting fixtures and controls	$ 116,200	$ -	$ (5,300)	$ 110,900	$ 89,700	21.9	7	$ 12,814
Olin unoccupied hours setback	$ 6,800	$ -	$ (20,700)	$ (13,900)	$ (96,700)	0.3	73	$ (1,325)
Olin variable speed ddrives	$ 25,400	$ -	$ (8,700)	$ 16,700	$ (18,100)	2.9	12	$ (1,508)
McGregory lighting fixtures and controls	$ 90,100	$ -	$ (7,000)	$ 83,100	$ 55,100	12.9	9	$ 6,122
McGregory unoccupied hours setback	$ 6,800	$ -	$ (14,500)	$ (7,700)	$ (65,700)	0.5	51	$ (1,288)
TOTALS	**$309,800**	**$ -**	**$ (81,800)**	**$ 228,000**	**$ (99,200)**	**3.8**	**187**	**$ (530)**

4.2.8 Adaptive computer power management and data center efficiency

IT equipment and data centers represent a significant use of energy at Colgate, both for the electricity needed to power the equipment and for cooling the area occupied by the university's servers. Over the past few years, Colgate's ITS department has made strides in reducing energy consumption while continuing to look for further opportunities to maximize the energy efficiency and performance of our individual computers, data centers, and overall IT programs. Currently, Colgate manages two existing data centers (one in the basement of Case-Geyer and a backup in O'Connor Campus Center. Additionally, the university owns over 2,400 computers of various types (PCs, Apples, Laptops, and other models).

Current practices and recent accomplishments:

- **Virtualization:** Beginning in the spring of 2009, Colgate's ITS team began consolidating Colgate's 110 servers. As of spring 2011, 55 servers have been reduced to 8 servers, significantly reducing Colgate's overall electricity consumption for space cooling and direct operation of the servers. Approximately 40 additional servers are scheduled for consolidation over the next couple of years.
- **Cloud computing:** In 2009, Colgate switched to GoogleApps, reducing the need for ITS to maintain servers and on-campus data centers while taking advantage of Google's larger, more efficient, centrally operated servers. Through this project, we reduced the number of Exchange servers from eight to two. This also eliminates the need for backup servers and storage. Additionally, we reduced our webservices from eight to three. Colgate's move to cloud computing further saves energy on campus.
- **EPA ENERGY STAR computers and monitors:** ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. The ENERGY STAR mark is the national symbol for energy efficiency, making it easy for consumers and businesses to identify high-quality, energy-efficient products and practices. All new ITS computer and monitor purchases are ENERGY STAR- certified.
- **EPEAT:** EPEAT is a procurement tool designed to help institutions such as Colgate evaluate, compare, and select electronic products based upon their environmental attributes as specified in the consensus-based IEEE Standard for the Environmental Assessment of Personal Computer Products (IEEE 1680.1). When practicable, Colgate University prefers to purchase computer products that have achieved EPEAT Silver or EPEAT Gold registration. The EPEAT registration criteria and a database of all registered products are provided at http://www.epeat.net. Several of Colgate's most recent computer purchases have been EPEAT-certified products (e.g., HP 8000 Elite that is EPEAT Gold-qualified).

Project Description:

This project looks at implementing adaptive power management software to further maximize energy conservation associated with Colgate's use of computers on campus. Adaptive power management software "learns" the behavior of each networked computer on campus and automatically powers down the computer when not in use. This type of software obviates the need for individual users to shut down or turn on their computers on a daily basis. Moreover,

machines can be programmed to "wake up" in order to push through upgrades/updates at a time that is most convenient for end users.

Milestone:
By 2014, Colgate utilizes adaptive power management software that will automatically power down networked computers when not in use.

Metrics and Timeline:
By 2014, Colgate implements adaptive power management software that reduces our electricity consumption by 540,000 kWh per year and saves about $17,000 per year.

Recommended Action:

- In FY 2012 and FY 2013, continue piloting different software companies and evaluating results.
- Work with end users and stakeholders to inform them of adaptive power management system and encourage behavior change.

Lead Responsibility:
ITS, Sustainability Office.

Table 15. *Adaptive computer power management with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Adaptive computer power management	$ 14,400	$ 2,700	$ (17,000)	$ 100	$ (57,100)	1.0	23	$ (2,531)

4.2.9 Green building

There presently is no set policy at Colgate for construction projects to meet or exceed the requirements for a USGBC LEED (United States Green Building Council Leadership in Energy and Environmental Design) or other green building construction standards. Minimizing the amount of energy each new or renovated building requires through high-performance design will help Colgate manage future greenhouse gas emissions. Ensuring sustainable building practices in campus projects—including LEED Certification for all applicable construction—is generally more cost-effective and easier to achieve during the initial design and construction than via future retrofit. Going forward, it is recommended that Colgate targets a 30–40% energy performance improvement over ASHRAE 90.1 2007, the minimum standard for a code-compliant building, for all new construction and major renovation projects.

Other aspects of construction project delivery can be improved through a rigorous building commissioning process that engages the commissioning team early in the design. Engagement of campus facilities operations and maintenance representatives in this process is an especially important part of the process.

Current practices and recent accomplishments:

- **Trudy Fitness Center:** The new Trudy Fitness Center is Colgate's first LEED-certified building.
- **Lathrop Hall Renovation:** this two-phase major renovation is striving for LEED certification.
- **Construction debris:** It is Colgate policy that contractors are required to recycle or responsibly remove any construction debris as part of doing work on the Colgate campus.

Milestone:
All new construction and major building renovations strive for LEED Silver standard or equivalent and a 30-40% energy performance improvement over ASHRAE 90.1 2007.

4.3 FOOD AND DINING

Colgate strives to improve the many dimensions that constitute a sustainable food program. Central New York is dairy and farming country and we continue to explore ever-increasing opportunities to serve locally produced, organically grown food on campus.

Buying local supports our farming community and allows us to form personal relationships with our neighbors, reduce our emissions associated with transporting large quantities of food from long distances, and helps ensure that our food is fresh and produced responsibly.

Current practices and recent accomplishments:

- Approximately 15% of Colgate's food purchases come from within a 200-mile radius of campus.
- Colgate Community Vegetable Garden. Environmental Studies students and members of the student club, Green Thumbs, led the effort in 2009 and 2010 to research and get approval for a half-acre vegetable garden on campus adjacent to Newell Apartments. Today, the garden is managed by students and food produced from the garden is served on campus.
- CNY Bounty. Beginning in 2010, CNY Bounty, in collaboration with Colgate's Sustainability Office, established a delivery location on campus. Colgate community members can now shop online for over 900 products from over 90 local farms and have it delivered to them weekly.
- Dan Purdy and Sons. Colgate's relationship with Dan Purdy and Sons of nearby Sherburne, N.Y., helps to streamline Colgate's purchase of locally produced food for our dining halls. As one of the only USDA federally inspected local agricultural processors of meats, poultry, and seafood in the region, Purdy and Sons is our campus's main distributor of local products.
- Common Thread Community Supported Agriculture. Starting in fall semester 2009, Dining Services began purchasing produce from Common Thread (located only 5 miles north of campus near Lake Moraine). Moreover, dozens of Colgate faculty and staff have shares through Common Thread including Colgate President Jeffrey Herbst and Dean of Faculty, Lyle Roelofs. By supporting Common Thread, shareholders get delectable and nutritious locally grown food while helping to support our local economy and neighbors.
- Fair Trade Coffee. Colgate Dining Services is dedicated to serving fair trade coffee in all resident and retail locations.
- The Colgate Hunger Outreach Program (CHOP) addresses issues of hunger in Madison County and strives to educate the Colgate community about the deeper issues surrounding hunger and poverty. Group members participate directly in one or more of the following ways: working in the Friendship Inn Soup Kitchen on Monday nights; volunteering at the Hamilton Food Cupboard on Tuesdays or Thursdays; and salvaging food from various locations on campus to deliver to the soup kitchen.
- Colgate Dining Services collaborates with local merchants to provide 80 meals weekly to the Friendship Inn.
- Salvage: Don't Throw it Out Campaign run by the Center for Outreach, Volunteerism, and Education (COVE) collects hundreds of pounds of unused food items at the end of the academic year and donates them to the Hamilton Food Cupboard and other charitable organizations in the region.
- All of Colgate's rice (white, brown, and basmati) is organic.
- Organic beans are used, including kidney, black, pinto, chili, lentil, split pea, and navy.
- Colgate offers a daily vegan option at its main dining facility.
- Refills on all beverages are discounted with your personal mug.
- All disposable cutlery is biodegradable.
- Colgate uses corn-based, bio-plastic containers that are 100% compostable. These containers can be found in every location where take-out food is available.
- Colgate's napkins are made from post-consumer content, chlorine-free, and completely compostable. Napkins are dispensed at each table to promote as-needed use and reduce overall waste.
- Dining Services recycles paper, cardboard, aluminum, plastic, and glass.

4.3.1 Dining Services switches to trayless operations

Trays in campus dining halls encourage students to take more food than they can generally eat. Research of 186,000 meals at 25 colleges and universities revealed a 25% to 30% reduction in food waste per person as a result of trayless dining.[17] Sodexo, Colgate's dining services contractor, reports that 40% of the campuses where they operate have switched to trayless operations resulting in an average of 30% reduced food waste.[18] This results in less food purchased, prepared, and cooked which reduces cafeteria costs. Less food waste also means less waste for staff to handle and dispose of which results in reduced landfill tipping fees and fewer greenhouse gas emissions. Trays also need to be washed which consumes water and energy.

Colgate's Dining Services currently prepares 2,500 meals per day that are served on trays. In Frank Dining Hall, the current conveyor belt system, on two rubber bands, was designed to move trays (dinner plates are too small to be moved by the system) and the trays need to be removed by employees in the dishroom as it is not a continuous loop. It is a 13-year old, labor intensive system that is prone to frequent breakdowns that result in increased congestion in the dining hall and disruption for the staff scraping and cleaning trays, and it requires an immediate response from Buildings and Grounds staff charged with fixing the system. Due to the unreliability and ongoing expense of maintaining this antiquated system, Dining Services hopes to replace it in the summer of 2012 (beginning of FY 2013).[19] The planned renovation creates an opportunity to implement trayless dining at Colgate.

Students in the Colgate Hunger Outreach Program (CHOP) have routinely held "Scrape the Plate" events in Frank Dining Hall and weighed an average of 130 lbs of food waste in a 2-hour stretch during dinner. Additionally, students in Environmental Studies 390 spent the Spring 2011 semester researching the environmental, economic, and social implications of implementing a trayless dining system in Frank Dining Hall. They concluded that Colgate could expect to reduce their annual food waste anywhere between 7.8 to 24.6 tons per year and save between $128,200 to $412,200 annually in food expenditures by switching to trayless dining.[20]

Milestone:
In 2013, Dining Services implements trayless dining in Frank Dining Hall.

Metrics and Timeline:
In 2013, Colgate reduces its annual food waste by approximately 10 tons and saves approximately $200,000 (of which the University would recoup $100,000 off a renegotiated contract) in annual food expenditures by implementing a trayless dining system in Frank Dining Hall.

Recommended Action:

- In FY 2012, establish an educational campaign that informs students of the benefits of switching to trayless dining.
- Following the renovation in Frank Dining Hall, conduct another pilot program to gauge community support of implementing trayless operations.

Lead Responsibility:
Dining Services, Sustainability Office

[17] The Business and Cultural Acceptance Case for Trayless Dining, http://www.aramarkhighered.com/assets/docs/whitepapers/ARAMARK%20Trayless%20Dining%20July%202008%20FINAL.PDF, ARAMARK, July 2008.
[18] Aramark (2008). The Business and Cultural Acceptance Case for Trayless Dining. Retrieved 27 June 2011. http://www.aramarkhighered.com/assets/docs/whitepapers/ARAMARK%20Trayless%20Dining%20July%202008%20FINAL.PDF.
[19] George Murray, director of dining services, e-mail communication, June 8, 2011.
[20] Burgett, C., Costello, A., Dennis, N., Felicetti, A., Horgan, J., and Johnescu, K. (2011). Exploring the Economic, Environmental and Social Implications of Trayless Dining at Colgate University. Colgate University, Environmental Studies 390, Spring 2011.

Table 16. *Trayless dining operations in Frank Dining Hall with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Trayless dining operations	$ 90,000	$ -	$ (100,700)	$ (10,700)	$ (413,500)	0.9	2	$ (206,750)

4.3.2 Increase purchase and consumption of local food on campus

The environmental impacts and greenhouse gas emissions associated with the production and transportation of food can be extensive. Purchasing local food—food that is grown and processed within 250 miles of the institution[21]—can minimize these impacts. Smaller, more local farms—as opposed to larger, intensely commercialized agribusinesses—often produce food in a more sustainable manner by employing organic growth methods, low tillage, efficient irrigation, less chemical inputs, and promoting a diversified crop base. These farming practices help to minimize agriculture's impact on the environment. Purchasing food from local producers also brings us in closer contact with the farmer thus forming stronger community bonds while at the same time boosting the local economy.

Current practices and recent accomplishments:
Spring 2010 ENST 480 students concluded that Colgate is currently purchasing about 15% of its food from within a 200-mile radius of campus. However, this was a ballpark figure and a more accurate estimate would be extremely beneficial for benchmarking purposes. Additionally, during fall semester 2010, Colgate community members placed 73 orders to the Colgate Drop Site, totaling $1,541 in sales through CNY Bounty.[22]

Milestone:

- By 2015, 30% of Colgate's food purchases come from local sources (within a 250-mile radius).

Metrics and Timeline:

- By 2015, 30% of Colgate's food purchases come from local sources (within a 250-mile radius).
- By 2015, the Colgate community exceeds $10,000 in annual purchases from CNY Bounty.

Recommended Action:

- Formally define "local" for Colgate University.
- Benchmark the amount of food grown and processed within a 250-mile radius of Colgate.
- Dining Services more clearly and consistently advertises local options.

Lead Responsibility:
Dining Services, Sustainability Office

4.4 LAND USE AND GROUNDS MAINTENANCE

Colgate owns approximately 1,780 acres of land of which 515 acres include the built environment, 876 acres are protected forest, and 389 acres are leased to local farmers. The built environment includes Taylor Lake, the Seven Oaks Golf Course, and over 2,200 inventoried trees. The Chenango Valley provides a scenic backdrop for Colgate's beautiful campus and historic stone buildings. According to the 2010 edition of the *Princeton Review*, Colgate was ranked as having the most beautiful campus in the country. The ranking was based on survey responses by 122,000 students at 371 top colleges. Campus landscaping and maintenance is managed by the Grounds Department of Facilities.

[21] AASHE STARS definition of local food as specified in STARS 1.0 Technical Manual, pg 108: http://www.aashe.org/files/STARS_1.0_Technical_Manual_Admin_Update_2.pdf.
[22] CNY Bounty delivers locally grown food to campus. http://cnybounty.com/.

Current practices and recent accomplishments:

- In 2010, Colgate consumed over 85,000,000 gallons of water costing the university nearly $1,000,000 in utilities. Much of this went for irrigating our landscape and athletic fields.
- In 2010, Colgate used 26,000 lbs of nitrogen-based fertilizer (24,000 lbs on main campus grounds and 1,600 lbs on the golf course) that contributed approximately 21 tons of greenhouse gas emissions.
- The Grounds Department is committed to using organic fertilizers as opposed to synthetic fertilizers on main campus grounds.
- Through careful tracking and monitoring, when one of the 2,200 trees requires maintenance or removal for safety concerns, another tree is planted in the general area. Through this effort, Colgate is adorned by a steady number of young, mature, and old trees on campus.
- All landscaping wood waste is chipped and used for fuel in Colgate's biomass heating plant.
- Colgate's 2007 University Forest and Open Lands Stewardship Plan emphasizes sustainable forestry and educational opportunities as an integral part of the management plan.

4.4.1 Establish 'reduced mow' areas

There are many areas throughout campus that get mowed on a weekly basis which could easily be turned into areas that are only brush hogged 1-2 times per year or perhaps not at all. There are approximately 30 acres of campus grounds that could be enrolled into a "reduced mow" concept. These would include parts of the old golf course, portions of the Cross Country Trails and Ski Hill, and in the area south of the townhouses. By having the grounds managers identify appropriate areas and reducing frequency to brush hogging 1-2 times per year, there is a reduction in labor hours and fuel usage. The reduction in mowing time would result in a savings of roughly 20 gallons of fuel per week through two different mowing units. The reduction in fuel usage would be picked up through the annual fuel reporting system which is the system of measure in this instance.

Milestone:
By 2013, we have 30 acres of campus grounds designated as "reduced mow" areas.

Metrics and Timeline:
This project is broken down into two phases.

- FY 2012: Phase 1 – Old Golf Course (9-acres) and Ski Hill (11-acres).
- FY 2013: Phase 2 – Payne Creek (5-acres) and Seven Oaks (5-acres).

Recommended Action:

1. Identify the specific locations to incorporate as `reduced mow' areas.
2. Work with campus structures (e.g., Campus Planning and Physical Resources Committee) to get proper approvals.
3. Create signage to identify areas as restoration and climate mitigation areas.

Lead Responsibility:
Grounds manager and crew.

Table 17. *`Reduced mow' areas with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Reduced mow areas (20 acres)	$ 1,200	$ -	$ (1,200)	$ -	$ (4,800)	1.0	4	$ (1,200)
Reduced mow areas (10 acres)	$ 600	$ -	$ (600)	$ -	$ (2,400)	1.0	2	$ (1,200)
TOTALS	**$ 1,800**	**$ -**	**$ (1,800)**	**$ -**	**$ (7,200)**	**1.0**	**6**	**$ (1,200)**

4.4.2 Reforestation of open spaces

There has been a great amount of interest in the past in planting trees as part of "green" initiatives from both students and faculty, so it would be effective to channel these interests into an annual event of reforesting open spaces on

Colgate property. Areas on the backside of the cross-country trails offer ample open space in order to begin a reforestation program. The end of April would provide a good time of the year to host an annual tree-planting event in celebration of both Earth Day (April 22) and Arbor Day (third Friday in April). Given proper support and recruiting, we anticipate two acres of open space land per year reforested with trees. This annual planting could result in nearly 30 acres of land being reforested over the course of 15 years. Costs would be relatively low as there are programs available that may be able to help supply appropriate trees at low cost.

Milestone:
By 2015, establish eight acres of campus grounds that are reforested. By 2025, establish a total of 30 acres of campus grounds that are reforested.

Metrics and Timeline:

- Reforest two acres of campus grounds annually until 2025.

Recommended Action:

1. Create a reforestation plan where we identify specific areas to be reforested over the course of the next 15 years.
2. Identify the types of trees we will plant in each identified location.
3. Begin promoting dates and recruit a volunteer work party.

Lead Responsibility:
Sustainability Office, Grounds Department, Students for Environmental Action, and other student groups.

Table 18. *Reforestation project with estimated costs and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Reforestation FY 2012 (2 acres)	$ 1,500	$ -	$ -	$ 1,500	$ 1,500	N/A	8	$ 188
Reforestation FY 2013 (2 acres)	$ 1,300	$ -	$ -	$ 1,300	$ 1,300	N/A	8	$ 163
Reforestation FY 2014 (2 acres)	$ 1,300	$ -	$ -	$ 1,300	$ 1,300	N/A	8	$ 163
Reforestation FY 2015 (2 acres)	$ 1,300	$ -	$ -	$ 1,300	$ 1,300	N/A	8	$ 163
TOTALS	**$ 5,400**	**$ -**	**$ -**	**$ 5,400**	**$ 5,400**	**N/A**	**33**	**$ 171**

4.4.3 Colgate forest sequestration (carbon accounting project)

Colgate University's forests sequester carbon each year. The university owns 1,046 acres of established forestland and another 204 acres of forests emerging from old pastureland through natural succession. Establishing a formal, long-term commitment to conserving these lands as "undeveloped" open space would guarantee continued sequestration of carbon and contribute to Colgate's goal of climate neutrality, in addition to the many other public benefits and ecosystem services this land provides.

This proposal is to establish a baseline for forest carbon accounting using a replicable set of accepted forest measurement procedures. This data will then be used to make projections of annual carbon sequestration using established models.

Milestone:
In 2013, Colgate begins accounting for annual forest sequestration rates by demonstrating a long-term commitment to forest preservation and by undertaking field measurements using commonly accepted methodologies.

Metrics and Timeline:

- In 2013, Colgate determines annual rate of forest carbon sequestration after completing field measurements and estimating carbon stocks.

- In 2015, Colgate remeasures permanent sample points to either confirm or alter annual rates of sequestration.

Recommended Action:

- Identify lands suitable for a long-term commitment to carbon sequestration and develop formal mechanism (e.g., rolling lease, conservation easement, etc.) to demonstrate long-term protection.
- Pursue third-party certification (e.g., Tree Farm standards) verifying that Colgate is managing our forest sustainably.
- Complete field measurements of Colgate forest properties.
- Evaluate annual rate of carbon sequestration using the *Forest Stand Vegetation Simulator*.
- Remeasure permanent data points confirming or altering initial estimates.

Lead Responsibility:
Sustainability Office, Grounds Department, Colgate forester.

Table 19. *Forest sequestration project with estimated costs and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Forest sequestration	$ 30,000	$ -	$ -	$ 30,000	$ 30,000	N/A	1,239	$ 35

4.4.4 Promote walking at Seven Oaks Golf Course

Encouraging walking play versus using gas-powered carts would be a first approach to reducing greenhouse gas emissions associated with fuel use at the Seven Oaks Golf Course. Implementing a marketing strategy that encourages golfers to be "green" and walk rather than ride when possible could be implemented through some very low-cost measures. Creating 2-3 visible signs emphasizing to customers that walking would be a better alternative to riding in gas-powered carts may help to slightly reduce the overall cart usage. Impact would most likely be relatively low, but it could promote a better public image and awareness around the course of the issues with using gas-powered carts. There exists a potential conflict of interest with the pro shop that endeavors to rent and profit from the cart use, so there would need to be a communication process with them in order to explain and facilitate the plan effectively. The costs involved could be kept very reasonable—likely less than $250—and there is opportunity for student ideas and involvement to help gain buy in from golfers.

Milestone:
In 2013, signage and marketing materials are created to promote walking at Seven Oaks Golf Course.

4.5 PROCUREMENT AND PURCHASING GUIDELINES

The goods and services that Colgate purchases on an annual basis have both environmental and social impacts and we recognize that we can use our purchasing power to support a more sustainable economy. Each purchasing decision presents an opportunity for Colgate community members to choose environmentally preferable products and services from companies that support sustainability.

Current practices and recent accomplishments:

- Colgate's Environmental Services Department uses cleaning products that are Green Seal-certified to meet GS-37 standards. We also have floor and hand-held machines which use ionized water to clean surfaces which have also been independently evaluated in their effectiveness. These products and practices provide a sanitary environment for our faculty, staff, and students while providing for a safer work environment for our employees.
- Colgate has an institution-wide preference to purchase EPA ENERGY STAR appliances and standard desktop computers and monitors.

- Colgate has reduced its consumption of paper by 4.3 million sheets in one year (from 12.8 million sheets in 2009 down to 8.5 million sheets in 2010).
- Colgate has an institution-wide preference to purchase recycled content office paper. In 2010, 75% of Colgate's paper purchases were from recycled content. This is up from 65% in 2009. To achieve this, Colgate reduced its consumption of non-recycled paper by 2.5 million sheets (from 4.6 million in 2009 to 2.1 million in 2010).

4.5.1 Create an environmentally preferable purchasing policy

Colgate will take proactive measures to reduce the negative environmental and social impacts of its purchasing decisions by creating and implementing a set of guidelines or directives for employees that promote sustainable purchasing on campus. Moreover, by specifying in our Terms and Conditions purchasing guidelines that Colgate will consider the amount of packaging when making purchasing decisions, the university can communicate to its suppliers our goal of reducing waste on campus. Through working with our major vendors/suppliers, we can reduce the amount of packaging and materials that enter the university in the first place.

Milestone:
By 2013, Colgate has in place an environmentally preferable purchasing policy that encourages employees to consider the environmental and social impacts of our purchasing decisions.

Lead Responsibility:
Purchasing Department, Sustainability Office.

4.5.2 Create a vendor code of conduct

By creating a vendor code of conduct, Colgate sets expectations that our vendors are to meet minimum standards of environmental and social responsibility. The goal is to influence and improve the sustainability of our supply chain. Besides our major office supply companies, shipping companies, and other retailers, this includes contractors and construction service companies which perform work on campus.

Milestone:
By 2013, Colgate has in place a vendor code of conduct that sets expectations that our vendors are to meet minimum standards of environmental and social responsibility.

Lead Responsibility:
Purchasing Department, Sustainability Office.

4.5.3 Purchasing preferences for Electronic Product Environmental Assessment Tool (EPEAT) certified computers and monitors on campus

EPEAT is a system that helps purchasers evaluate, compare, and select electronic products based on their environmental attributes, e.g., waste minimization, high recycled content, environmentally responsible production methods, and demonstrates maximum durability or biodegradability, reparability, energy efficiency, and non-toxicity. The EPEAT system currently covers desktop and laptop computers, thin clients, workstations, and computer monitors. Desktops, laptops, and monitors that meet 23 required environmental performance criteria may be registered in EPEAT by their manufacturers in 40 countries worldwide. Registered products are rated Gold, Silver, or Bronze depending on the percentage of 28 optional criteria they meet above the baseline criteria. Currently, over 1,600 products have been certified through the EPEAT system.

Milestone:
By 2013, Colgate has in place an EPEAT-preferred purchasing guideline and the campus standard is to purchase EPEAT-qualified computers and monitors.

Metrics and Timeline:
By 2015, 50% of Colgate's computers and monitors are EPEAT-certified models.

Recommended Action:

- Inventory current models of computers and monitors to evaluate those that meet EPEAT certification.
- Identify a few applications on campus where EPEAT-certified products make good sense (high-performing models; affordable pricing) and purchase those items as the campus standard.

4.5.4 Implement a $50 minimum for department orders from Staples and Office Max

Increasing the minimum departmental purchase order from the current $35 to $50 would result in significantly fewer deliveries to campus. In 2010, Colgate administrative staff placed over 440 orders to Staples that were under $50. The $50 minimum strategy would reduce the number of vehicle trips to campus from our suppliers thus reducing congestion, cost, and emissions associated with fuel use. This strategy would also result in combined orders which could have a modest reduction in the amount of packaging that enters campus. We conservatively estimate a 1% reduction (8 tons) in annual landfill waste from our 2009 baseline year and a savings of $500 in tipping fees.

Milestone:

By 2012, Colgate establishes a new minimum purchase order of $50 from Staples and Office Max.

Metrics and Timeline:

- In 2012, Colgate reduces landfill waste by 8 tons and greenhouse gas emissions by 1.3 MTeCO2 due to decreased packaging coming to campus associated with fewer deliveries from our major suppliers.

Recommended Action:

1. Work with Colgate's purchasing department to implement a new $50 minimum purchasing guideline for all purchases through Staples and Office Max.
2. Communicate new guidelines to Colgate community.

Lead Responsibility:

Purchasing Department, Sustainability Office.

Table 20. *Estimated cost savings and greenhouse gas reductions associated with a $50 minimum purchasing policy from Staples and Office Max.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
$50 minimum purchase order	$ -	$ -	$ (500)	$ (500)	$ (2,500)	0.0	1	$ (2,500)

4.5.5 Recycled paper purchasing policy (eliminate non-recycled paper on campus)

In FY 2010, Colgate purchased 880 cartons of 30% recycled content paper, 421 cartons of 100% recycled content paper, 404 cartons of virgin paper (non-recycled), and 36 cartons of 50% recycled paper. This project proposes a policy that eliminates the purchase of non-recycled paper on campus. We assume that people who purchased non-recycled paper in 2010 would switch to 30% recycled paper from Office Max in 2011. Because 30% recycled paper is $3.04 cheaper per carton and is a lower emissions factor than non-recycled paper, Colgate would save $3,800 and reduce our carbon footprint by nearly 3 MTeCO2 if we implemented this policy. Furthermore, these figures assume 2009-2010 consumption habits; if adjusted for the exceptionally large freshman class, Colgate could realize even greater environmental and fiscal savings.

Milestone:

By 2012, Colgate establishes a new paper purchasing policy that eliminates the purchase of non-recycled paper.

Metrics and Timeline:

- Save $3,800 in paper purchasing due to more cost competitive pricing of 30% recycled paper over non-recycled paper.
- Reduce Colgate's carbon footprint by three MTeCO2 in 2012 compared to 2009 baseline due to eliminating the purchase of non-recycled paper.

Recommended Action:

1. Work with Colgate's purchasing department to write new paper purchasing policy.
2. Communicate new policy to Colgate community.

Lead Responsibility:
Purchasing Department, Sustainability Office.

Table 21. *Recycled paper purchasing policy with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	$ (3,800)	$ (19,000)	0.0	3	$ (6,333)

4.5.6 Increase multi-functional printer/copier/fax devices as campus standard

Replacing stand alone printers, copiers, and fax machines with multi-functional devices (MFDs) can save space, cost in maintenance and repairs, and energy consumption. Additionally, research is demonstrating that MFDs can speed office workflow, increase efficiency, cut costs, and aid productivity. Currently, Colgate has very few MFDs on campus.

Milestone:
By 2013, Colgate establishes new standard of replacing stand alone devices with MFDs in campus work areas.

Metrics and Timeline:
By 2015, Colgate replaces stand alone devices with MFDs in 50% of the campus's work areas.

Recommended Action:

- Complete assessment of current infrastructure and propose new layout that includes MFDs.

Lead Responsibility:
ITS, Purchasing Department, Sustainability Office.

4.5.7 Purchase items/products with packaging/materials that can be recycled, made of post-consumer content, or are environmentally benign

Through working with our major vendors/suppliers, we can influence the type of packaging and materials that enter the university. This strategy would have important environmental benefits. Materials and packaging that can be recycled use less overall energy and less extraction of finite resources. Additionally, items made from plant-based materials (e.g., "green" packaging peanuts which are starch-based and biodegradable in water or a compost setting) avoid the harsh and persistent toxins found in plastics and Styrofoam and are now widely available. Influencing Colgate's supply chain can be challenging. However, as the "green" movement continues to progress, many of our suppliers are already moving in this direction. Much of the time and energy needed to make this initiative successful would fall in the lap of Colgate's director of purchasing in collaboration with the campus sustainability coordinator. Administrative assistants would also need to be made aware of opportunities and alternative choices.

Milestone:
In 2012, Colgate continues dialogue with major suppliers expressing our preference to purchase items/produces with environmentally conscious packaging.

4.6 GROUND TRANSPORTATION

In 2009, employee commuting was responsible for approximately 1,626 MTeCO2 emissions, nearly 10% of Colgate's total emissions.

These emissions are likely to decrease in the future even if Colgate takes no action at all. Currently, Corporate Average Fuel Economy (CAFE) standards require an average fuel economy of about 28 mpg for cars and 22 mpg for light trucks,

and the average fuel economy of passenger vehicles on the road is near 21 mpg, according to the Bureau of Transportation Statistics. According to a new EPA CAFE ruling, the standard will be raised to 35 mpg for new cars for the combined fleet average by 2016. That is a 42% improvement in fuel efficiency over today's vehicle fleet. Once these new vehicles are on the road, emissions should decrease at Colgate by 20–40% even if no actions are taken at the institutional level, unless commuting distances increase to compensate. However, since our Sustainability and Climate Action Plan is focused on action items that we can implement within the next five years, the impact of the new emissions standards will not be considered as a mitigation strategy.

The Colgate vehicle fleet consists of 95 vehicles (22 student/faculty vans, 68 Buildings and Grounds vehicles, and 5 Campus Safety vehicles) and is responsible for approximately 400 MTeCO2 emissions per year, about 2% of Colgate's total emissions.

Finally, the Colgate Cruiser is responsible for approximately 70 MTeCO2 emissions per year, 0.4% of Colgate's total emissions. While its emissions are minimal, its cost to the university is substantial, so, independent of the Climate Action Plan, the university will want to ensure that the Cruiser is scheduled efficiently.

4.6.1 Encourage carpooling

A 2010 transportation survey administered by Environmental Studies students revealed that of the 318 employees who answered the question about whether they would consider carpooling, 122 people (38%) answered either "yes" (18 respondents) or "maybe" (104 respondents). An additional 12 people said that they were already carpooling; the remaining 184 responded "unlikely" or "never." With this significant level of interest in carpooling, it is possible that Colgate can increase its carpooling rates from the current 4% level to 10% of employees or 96 (960 employees X 0.10) individuals. If we assume that each carpool consists of two people, then we can form approximately 50 carpools. If we spread this initiative out over four years, we would average 12 new carpools per year.

In 2010, Colgate joined an online rideshare program called Purpool that was created by faculty members at SUNY Purchase with a New York State Energy Research and Development Authority (NYSERDA) grant. Members of the Climate Action Plan Transportation Subcommittee selected this rideshare program because it is user-friendly, private to the Colgate community, and free of charge. Purpool is open only to the Colgate community, so user information will not be shared publicly. Only employee names, emails, and zip codes will be shared among the Colgate community.

Milestone:
By 2015, at least 48 new carpools are formed involving 96 employees.

Metrics and Timeline:

- Establish 12 new carpools per year for the next four years.

Recommended Action:

- Promote and incentivize the Purpool rideshare program.

Lead Responsibility:
Sustainability Office, Sustainability Council, Human Resources.

Table 22. *Carpooling estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST YEAR NET COST/SAVINGS	FIVE YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Carpooling FY 2012 (12 carpools)	$ -	$ 500	$ -	$ 500	$ 2,500	N/A	18	$ 141
Carpooling FY 2013 (12 carpools)	$ -	$ -	$ -	$ -	$ -	N/A	18	$ -
Carpooling FY 2014 (12 carpools)	$ -	$ -	$ -	$ -	$ -	N/A	18	$ -
Carpooling FY 2015 (12 carpools)	$ -	$ -	$ -	$ -	$ -	N/A	18	$ -
TOTALS	**$ -**	**$ 500**	**$ -**	**$ 500**	**$ 2,500**	**N/A**	**72**	**$ 35**

4.6.2 Encourage employee bicycle commuting

In the 2010 transportation survey administered by Environmental Studies students, of 323 employees who answered the question about whether they would consider bicycling, 60 people (19%) responded either "yes, if I had a bicycle" (15 respondents) or "maybe" (45 respondents). An additional 24 people said that they were already bicycling; the remaining 239 responded "unlikely" or "never."

Of the total group of 84 respondents who already bicycle or might want to bicycle, the percent who would be more likely to bicycle given the following incentives/assistance were:

- Better bicycle parking 30%
- Information about safer routes 6%
- Free showers and lockers 13%
- Pre-tax accounts for bicycle expenses 18%
- Low cost bicycle purchase or rental 20%
- Park-and-ride locations 6%
- Bicycle racks for the Cruiser 10%
- Rides home in bad weather 35%

Nearly 500 Colgate employees live in the immediate Hamilton area, presenting many opportunities to increase bicycle commuting to work.

With the assumption that most bicyclers will choose other transportation methods when the weather is bad, a reasonable goal is to add 20 half-time bicyclers per year over the next three years.

Milestone:
By 2015, at least 60 employees become half-time bicycle commuters.

Metrics and Timeline:

- Create 20 new half-time bicycle commuters per year between FY 2013 and 2015.
- Purchase 10 new bikes per year between FY 2013 and 2015 specifically to encourage employee commuting.

Recommended Action:

- Promote and incentivize bicycle commuting on campus.
- Hire student intern to help create, manage, and promote the program.

Lead Responsibility:
Sustainability Office, Sustainability Council, Human Resources, Health and Wellness Initiative.

Table 23. *Employee bicycle commuting with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Employee bicycle commuting FY 2013 (10 new bikes & bike racks)	$ 4,500	$ 5,100	$ -	$ 9,600	$ 30,000	N/A	4	$ 7,758
Employee bicycle commuting FY 2014 (10 new bikes)	$ 2,000	$ -	$ -	$ 2,000	$ 2,000	N/A	4	$ 517
Employee bicycle commuting FY 2015 (10 new bikes)	$ 2,000	$ -	$ -	$ 2,000	$ 2,000	N/A	4	$ 517
TOTALS	**$ 8,500**	**$ 5,100**	**$ -**	**$ 13,600**	**$ 34,000**	**N/A**	**12**	**$ 2,931**

4.6.3 Encourage student bicycle commuting

Out of the total population of nearly 2,800 students, 752 have registered cars on campus (approximately 27%).[23] However, survey results reveal that the vast majority of students are not using their vehicles to commute back and forth to classes. Furthermore, Colgate does not allow student parking during the week between 8:00 a.m. and 3:00 p.m. In fact, most students commute by walking (78%), biking (10%), taking the Cruiser, or carpooling[24]. With this being said, there appears to be an opportunity to further encourage and promote bicycle ridership. According to a 2010 bicycle commuting survey, the lack of owning a bike was the most popular reason for not riding a bicycle at Colgate (72.5%) while 70% of current bikers responded that they wanted more bike racks[25].

Milestone:

The number of students who commute by bicycle increased from 10% in 2010 to 15% in 2015.

Metrics and Timeline:

- Purchase 10 new bikes per year (30 total) between FY 2013 and 2015 to encourage student bicycle commuting.
- Purchase 10 new bike racks between FY 2013 and 2015 to encourage student bicycle commuting.

Recommended Action:

- Acquire 30 new bikes by 2015 to include in the Green Bikes program.
- Install new bike racks at Newell Apartments, in Parker Complex and outside Case-Geyer Library.
- Implement a campaign to make students more aware of the Green Bikes program and the environmental and health benefits associated with bicycling.
- Hire student intern to help create, manage, and promote the program.

Lead Responsibility:

Sustainability Office, Sustainability Council, SGA, Health and Wellness Initiative.

[23] Moses, S. 2009 Fall; Core 128. Carbon Mitigation: Student commuting. Colgate University, Hamilton, NY, USA

[24] Nguyen, T. 2010 Fall; F-SEM 124. Bicycle usage at Colgate and how we can encourage bicycle usage. Colgate University, Hamilton, NY, USA

[25] Ibid.

Table 24. *Student bicycle commuting with estimated cost savings over time.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Student bicycle commuting FY 2013 (10 bikes & bike racks)	$ 4,500	$ 2,000	$ -	$ 6,500	$ 14,500	N/A	-	N/A
Student bicycle commuting FY 2014 (10 bikes)	$ 2,000	$ -	$ -	$ 2,000	$ 2,000	N/A	-	N/A
Student bicycle commuting FY 2015 (10 bikes)	$ 2,000	$ -	$ -	$ 2,000	$ 2,000	N/A	-	N/A
TOTALS	**$ 8,500**	**$ 2,000**	**$ -**	**$ 10,500**	**$ 18,500**	**N/A**	**-**	**N/A**

4.6.4 Create policies to encourage flexible work schedules

Reducing employee commuter emissions and encouraging carpooling will be more successful if employees can work more flexible hours. Nineteen percent of employees who expressed interest in carpooling (or 7% of all employees) said that flexible work hours would make them more likely to try carpooling. Additionally, some employees might be able to work from home successfully for 1–2 days per week, or to work four 9 to 10-hour days on campus instead of five 7.5-hour days. These policies all have the potential to reduce emissions from employee commuting. However, many employees are needed on campus for particular hours, so flexible scheduling policies will reduce commuting emissions only for a certain percentage of employees.

Milestone:
By 2014, 10% of Colgate employees incorporate flexible work hours into their work schedule.

Metrics and Timeline:

- Through more flexible scheduling, 70 employees reduce their annual commuting emissions by one-fifth or 33 gallons per commuter.

Recommended Action:

- Human resources further investigates opportunities to incorporate flexible scheduling in our workforce.

Lead Responsibility:
Human Resources.

Table 25. *Employee flex schedules with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Flexible working schedules	$ -	$ -	$ -	$ -	$ -	N/A	21	$ -

4.6.5 Zipcar service to campus

Recent changes to Zipcar's policies have removed the requirement that the university guarantee a certain level of monthly business. The current policy requires only that Colgate provide parking spaces and some routine administration (such as checking cars for cleanliness). The SGA is lobbying for Zipcars to be brought to campus. Student driving is not included in Colgate's emissions, but the existence of Zipcars may also impact Colgate's emissions. For example, Zipcars can be used as part of Colgate's emergency ride home program for carpoolers or bicyclers. Also, some smaller student groups might choose to use a Zipcar rather than a Colgate transportation vehicle.

Milestone:
Beginning in 2012, Colgate has access to two Zipcars on campus.

Lead Responsibility:
SGA, Purchasing Department, Sustainability Office.

4.6.6 Offer group purchasing of fuel-efficient vehicles

Since Colgate's greenhouse gas emissions will decrease if employees purchase more fuel-efficient cars, it is in Colgate's interest to help employees make these purchases. Colgate could support these purchases by helping employees negotiate a group purchase plan with a dealership.

Milestone:
By 2015, Colgate offers employee purchasing discounts for fuel-efficient vehicles.

Metrics and Timeline:
Commuter emissions decrease by 10% off of the 2010 baseline by 2015 as a result of this program.

Recommended Action:
Purchasing Office looks into options for group purchasing of fuel-efficient vehicles.

Lead Responsibility:
Purchasing Department.

4.6.7 Purchase electric vehicles

Colgate's vehicle fleet includes about 15 vehicles that would be suitable for replacement with low-speed electric vehicles. Electric trucks have official payloads of ~1500 lbs, but in the initial purchase, it would be best not to approach this limit. Colgate's light-duty vehicles include ones that are used to transport custodians on campus, and also vehicles used by ITS, athletic trainers, mail services, the locksmith shop, the paint shop, and preventive maintenance to transport employees and light equipment. Over the next few years, approximately six of these are likely to be replaced presenting an opportunity for Colgate to purchase electric vehicles . If Colgate wishes to be particularly cautious, leasing options exist.

Milestone:
By 2015, six electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.

Metrics and Timeline:
Starting in 2013, replace an average of two internal combustion vehicles per year with electric models.

Recommended Action:
1. Identify specific vehicles to replace with electric models.
2. Work with B&G staff to ensure that jobs can be performed adequately if electric vehicles were used.

Lead Responsibility:
Purchasing department, Buildings and Grounds.

Table 26. *Electric vehicles with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Electric vehicle FY 2013 (2 vehicles)	$ 3,000	$ -	$ (2,200)	$ 800	$ (8,000)	1.4	3.7	$ (2,232)
Electric vehicle FY 2014 (2 vehicles)	$ 3,000	$ -	$ (2,200)	$ 800	$ (8,000)	1.4	3.7	$ (2,232)
Electric vehicle FY 2015 (2 vehicles)	$ 3,000	$ -	$ (2,200)	$ 800	$ (8,000)	1.4	3.7	$ (2,232)
TOTALS	**$ 9,000**	**$ -**	**$ (6,600)**	**$ 2,400**	**$ (24,000)**	**1.4**	**11**	**$ (2,232)**

4.6.8 Purchase hybrid-electric vehicles

Vehicles that are used for long trips or on highways are not currently suitable for replacement with electric vehicles. However, hybrid-electric vehicles can be appropriate substitutions. There are seven campus vehicles that might be appropriate to replace with hybrid-electrics, including those used by admissions, athletics recruiting, and campus safety. Of these, three are likely to be replaced in the next couple of years.

Milestone:
By 2015, three hybrid-electric vehicles replace traditional gasoline vehicles in Colgate's vehicle fleet.

Metrics and Timeline:
Starting in 2013, replace an average of one internal combustion vehicle per year with hybrid-electric models.

Recommended Action:

1. Identify specific vehicles to replace with hybrid-electric models.
2. Work with Colgate employees staff to ensure that jobs can be performed adequately if hybrid-electric vehicles were used.

Lead Responsibility:
Purchasing Department, Finance and Administration.

Table 27. *Hybrid-electric vehicles with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Hybrid-electric vehicle FY 2013	$ 2,000	$ -	$ (1,000)	$ 1,000	$ (3,000)	2.0	3	$ (1,076)
Hybrid-electric vehicle FY 2014	$ 2,000	$ -	$ (1,000)	$ 1,000	$ (3,000)	2.0	3	$ (1,076)
Hybrid-electric vehicle FY 2015	$ 2,000	$ -	$ (1,000)	$ 1,000	$ (3,000)	2.0	3	$ (1,076)
TOTALS	**$ 6,000**	**$ -**	**$ (3,000)**	**$ 3,000**	**$ (9,000)**	**2.0**	**9**	**$ (1,076)**

4.6.9 Biodiesel (B20 blend)

Biodiesel is a low-carbon vegetable oil- or animal fat-based alternative to diesel fuel. Biodiesel blends are now available through the diesel fuel marketplace with competitive pricing. Blends of less than 20% biodiesel can be used in Colgate's existing diesel fleet with no, or only minor, modifications.

This project looks at replacing 5,000 gallons of diesel fuel with B20 (20% biodiesel, 80% petrodiesel) blend.

Milestone:
In 2012, Colgate purchases 5,000 gallons of B20 to help fuel our diesel fleet.

Metrics and Timeline:
During 2013, Colgate reduces greenhouse gas emissions by 11 MTeCO2 and saves $500 by replacing 5,000 gallons of diesel fuel with B20.

Recommended Action:

1. Establish contract with diesel fuel distributor to procure biodiesel.
2. Communicate biodiesel use with mechanics and vehicle fleet operators.

Lead Responsibility:
Associate vice president for facilities; mechanic, grounds manager; B&G staff.

Table 28. *Biodiesel project with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Biodiesel (B20 blend)	$ -	$ -	$ (500)	$ (500)	$ (2,500)	0.0	11	$ (227)

4.6.10 Implement a `no idling' policy

Idling for 10 minutes typically uses the same fuel as driving one mile. Vehicle idling wastes fuel, but is not normally necessary for safety, and, contrary to widespread belief, actually decreases engine life rather than increasing it. This project would result in a new campus-wide policy that prohibits idling for more than five minutes at a time. `No idling' signage would also be a part of this project in order to help reinforce and communicate this new policy.

Milestone:
By 2012, Colgate has a campus-wide `no idling' policy in place.

Metrics and Timeline:
By 2012, have a policy statement written and endorsed as a new campus policy.

Recommended Action:

1. Implement new campus-wide `no idling' policy.
2. Install new signage to alert drivers of campus policy.

Lead Responsibility:
Associate vice president for facilities; grounds manager; Campus Safety.

Table 29. *`No idling' policy with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
No idling policy	$ 1,000	$ -	$ (5,200)	$ (4,200)	$ (25,000)	0.2	13	$ 1,996

4.7 AIR TRAVEL

In 2009, Air travel was responsible for approximately 4,647 MTeCO2 emissions, nearly 27% of Colgate's total emissions.

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.

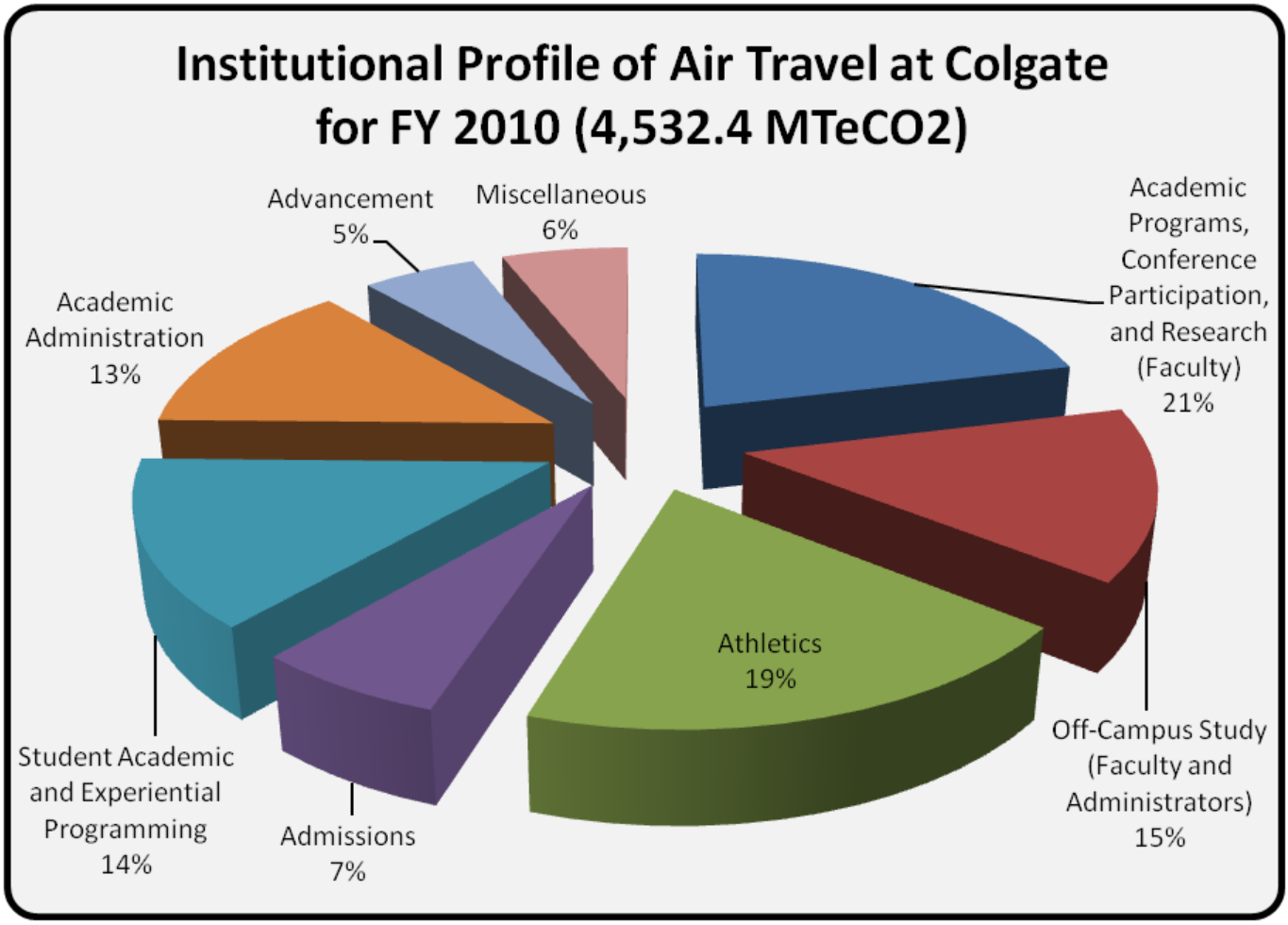
Unlike certain other areas covered in the climate action planning process, air travel is not susceptible to significantly increasing efficiencies with current technologies; it is an inherently carbon-intensive form of transportation. Therefore, any reduction of the carbon emissions associated with Colgate's business-related air travel will need to stem from a reduction in air miles traveled. The vast majority of Colgate's air travel emissions will eventually have to be offset in order to achieve the overall goal of climate neutrality under ACUPCC.

Current practices and recent accomplishments:
As of June 1, 2010 (i.e., the start of fiscal year 2011), 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 carbon 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.

The Air Travel Subcommittee distinguished the amount of air travel by various institutional categories (Figure 5). They did this both to capture the current institutional profile of air travel at Colgate and to allow for tracking trends across the institution over time.

Figure 5. *Air travel emissions by various institutional categories.*



4.7.1 Increase use of video and teleconferencing options

One potential mitigation strategy to reduce the need for air travel involves the increased use of newer video and teleconferencing technologies such as Skype and Tandberg's Movi software system.

Milestone:
By 2014, Colgate staff, faculty, and students significantly increase the use of video conferencing technologies to connect with colleagues and peers at other institutions.

Metrics and Timeline:
By 2014, Colgate reduces air travel emissions by 2% from 2010 emissions due in part to increased use of new video and teleconferencing technologies.

Recommended Action:
Upgrade current Cisco VOiP system and further research and identify the best video and teleconferencing options for Colgate.

Lead Responsibility:
ITS.

Table 30. *Videoconferencing technology with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Videoconferencing	$ 35,200	$ -	$ (19,000)	$ 16,200	$ (59,800)	1.9	100	$ (598)

4.7.2 Purchase individual carbon offsets for air travel

As an institution, Colgate is still considering its options for purchasing offsets on the voluntary market. Individuals traveling on Colgate business, however, can already avail themselves on an individual and voluntary basis of a range of options for offsetting their travel. Terrapass, for example, provides this possibility both in partnership with Expedia and through direct purchase of offsets for air travel. In the former case, a passenger is able to add a Terrapass carbon offset in the process of purchasing a ticket online via Expedia.[26] In the latter case, a passenger can purchase the offset directly from Terrapass (http://www.terrapass.com/) either by estimation or through directly entering flight information at Terrapass' air travel carbon footprint calculator.[27] Terrapass' current cost structure involves paying $5.95 per 1,000 pounds of eCO2. Using the website's calculator, the offset cost for a flight from Syracuse to Denver via Washington, D.C., for example, is calculated as involving travel of 3,488 miles, equaling emissions of 1,586 lbs CO2. Terrapass rounds this out to the nearest 1000 pounds of eC02, resulting in an offset price of $11.90. It's also worth mentioning that the calculator provides comparative information on the emissions that would be associated with an individual's driving or carpooling for that same distance, so it is presented in an educative way. Given the relative affordability of such offsets, as well as the informative interface provided in this example by Terrapass, it may be appropriate to publicize the possibility of such voluntary purchases of carbon offsets to the Colgate community.

Milestone:
By 2012, encourage Colgate staff, faculty, and students to explore the option of offsetting their travel by providing reputable options and user-friendly information for offsetting.

4.8 WASTE MINIMIZATION AND RECYCLING

A number of initiatives and programs can be implemented to reduce the overall amount of waste Colgate sends to the landfill. Preventing unnecessary materials and packaging from entering the university in the first place, offers the first important strategy in reducing Colgate's landfill waste. We refer to this as source reduction. Purchasing decisions, new policies, and working with major supplies/contractors are all important options here. Source reduction strategies reduce the amount of packaging and materials before they enter the campus waste stream. Focusing on source reduction is important because it reduces labor and time (through handling, storage, and separation) and reduces greenhouse gas emissions through less waste entering, and therefore, leaving the university.

Once items, materials, and packaging make it to campus, options exist to divert them from the landfill once they are deemed no longer useful by the Colgate community. This includes reusing or donating items and materials such as office supplies, electronic equipment, furniture, etc. Strategies that focus on reuse keep items out of the landfill through salvage programs, donations, and giveaway options. "One person's trash is another's treasure" captures the essence of focusing on reuse as a strategy.

Items that reach the end of their useful life may be recyclable and made into new products. Recycling strategies keep items out of the landfill through better recycling infrastructure, increased recycling rates, and changing social norms. Paper use and behavior change are also important areas where mitigation is possible. In Fiscal Year 2009, Colgate

[26] Website accessed in January 2011: http://www.expedia.com/daily/sustainable_travel/going_green/carbon_footprint.asp.
[27] http://www.terrapass.com/carbon-footprint-calculator/#air

consumed over 12.8 million sheets of paper which is equivalent to over 130,000 lbs or 65 tons. This contributed to over 278,000 lbs or 139 tons of greenhouse gas emissions. Consuming less paper, recycling more of it, and purchasing recycled or tree-free paper are all strategies that would reduce emissions. Additionally, there are many opportunities to reduce landfill waste due to behavior change or changes in social norms on campus. We have identified two strategies in particular that will help landfill waste reduction: Green Living Program and Green Office Program. See section 4.1 for more detailed information on these behavior-change programs.

And, finally, composting organic matter (yard waste and food scraps) can result in huge reductions in our landfill waste stream. Perhaps the single most important strategy Colgate could implement to reduce landfill waste would be to create a composting program. By weight, food scraps make up a significant portion of our landfill waste.

Specific mitigation strategies under each of these key areas will be explored in more detail in this section.

Current practices and recent accomplishments:
From 2008 to 2010, Colgate reduced its landfill waste by 150 tons (Table 31). This was accomplished in large part by:

- recycling at all campus events including, but not limited to, special ceremonies, evening lectures, social gatherings, alumni reunions, orientation events, home football and hockey games, and community events of all kinds;
- composting at various events such as brown bag lunches, Reunion College 2010, and special events;
- increased education and awareness led to increased recycling rates;
- increased recycling infrastructure. Colgate purchased new recycling bins for better coverage and increased recycling opportunities;
- developing new easy-to-see-and-read recycling signs. The Sustainability Office created new recycling signs that are posted above recycling bins. This reduces contamination and helps educate students on how to recycle;
- decreased paper consumption. From 2009 to 2010, Colgate reduced its paper consumption by over 4.2 million sheets of paper (from 12.8 to 8.6 million sheets). 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;
- initiating a new electronic waste recycling program for small personal electronic devices;
- encouraging the use of refillable drinking containers during various campus events.

Colgate also experienced a significant reduction in emissions in FY 2010 associated with our landfill waste because the county landfill installed a methane capture and electric generation system that has much lower greenhouse gas emissions per ton:

- **No methane recovery:** emissions factor = 1.0842857 MTeCO2/short ton
- **Methane recovery and electric generation:** emissions factor = 0.160634921 MTeCO2/short ton

Table 31. *Colgate landfill waste, 2008–2010.*

Fiscal Year	Total Landfill Waste (tons)	Annual Difference (tons)
2008	929	----
2009	813	116
2010	778	34
Total Reduction		**150**

4.8.1 On-site composting project

Colgate University currently pays $62.50 per ton of landfill waste. In 2009, Colgate paid nearly $50,000 to landfill over 800 tons of garbage. This contributed 881 tons to Colgate's greenhouse gas footprint. Separating organic waste for composting would reduce Colgate's landfill tipping fees and greenhouse gas footprint. If we composted both pre- and post-consumer non-meat and non-dairy organic waste from Frank, Merrill House, Coop, The Edge, and catered events, we would reduce our annual landfill waste by approximately 130 tons per year. This would save $8,125 annually and reduce our greenhouse gas emissions by 20.9 tons.

Milestone:

By 2013, we will have implemented a pre- and post-consumer composting program at Colgate University. This project will be implemented in two phases:

- FY 2012: Phase 1 – Pre-consumer composting is implemented in Frank, Merrill House, Coop, and The Edge.
- FY 2013: Phase 2 – Post-consumer composting is implemented in Frank, Merrill House, Coop, and The Edge.

Metrics and Timeline:

By 2013, we will be composting approximately 130 tons of organic food waste annually.

Recommended Action:

1. Procure designated compost containers and coordinate activities between Dining Services and B&G staff.
2. Consider putting in a curing pad at the compost site.
3. Hire and train student interns to help maintain the composting site.

Lead Responsibility:

B&G Department, Sustainability Office, Dining Services, and Composting Club.

Table 32. *On-site composting with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
On-site composting (Phase 1: pre-consumer)	$ 7,000	$ 4,100	$ (3,100)	$ 8,000	$ 12,000	N/A	8	$ 1,494
On-site composting (Phase 2: post-consumer)	$ -	$ -	$ (5,000)	$ (5,000)	$ (25,000)	0.0	13	$ (1,945)
TOTALS	**$ 7,000**	**$ 4,100**	**$ (8,100)**	**$ 3,000**	**$ (13,000)**	**0.6**	**21**	**$ (623)**

4.8.2 Reuse and redistribution of used office equipment and supplies (office swap program)

Create an online office swap database for community members to post items they either need or want to get rid of. This would encourage reuse and potentially prevent the order of new items and the disposal of items that are still functional and could be of use to another employee/office. By keeping office items (binders, notebooks, paper clips, lamps, envelopes, etc.) out of the waste stream, we can have a modest-to-significant reduction in greenhouse gas emissions. We conservatively estimate a 2% reduction in annual landfill waste due to this strategy. This would amount to a 16-ton reduction of our landfill waste total from our 2009 baseline year. This initiative is incorporated into the Green Office Program.

Milestone:

By 2013, we will have over 100 postings of items to be swapped through the program.

4.8.3 Establish 0.5" paper margins as campus guideline

By increasing the margins from the standard 1" setting to 0.5" would save paper. We estimate that this would be a modest savings of about a 1% reduction in overall paper use. This would reduce our overall paper use by 56,917 sheets of paper, saving the university $371 in paper costs while reducing our greenhouse gas footprint by 0.65 MTeCO2. This initiative is incorporated into the Green Office Program.

Milestone:
In 2012, we promote 0.5" margins by informing employees how to set this as a default at their workstations.

4.8.4 Reduce the use of one-time-use cups during campus events

Colgate would avoid spending money in purchasing one-time-use cups while saving money in landfill tipping fees. Additionally, time and labor would be saved in cleanup and disposal if we encouraged attendees to bring their own refillable water containers or provided reusable containers at campus events. Avoiding the use of one-time-use disposable beverage containers also results in fewer containers taking up space in the landfill while avoiding the harmful release of emissions and chemicals into the environment during manufacture, transportation, and disposal of said containers.

Milestone:
During 2012, we continue to educate event planners/organizers to encourage attendees to bring their own cups/mugs instead of providing one-time-use disposable cups.

Annual Savings:
Colgate would realize immediate savings in the cost of landfill tipping fees. Depending on the type of alternative, we could also eliminate (or reduce) the cost of purchasing disposable cups.

Annual Greenhouse Gas Reduction Potential:
This strategy would likely result in a modest reduction (1 to 10%) in the amount of greenhouse gases Colgate emits. Since disposable cups are generally lightweight (we measure emissions by the ton of waste) and the emissions factor for the Madison County landfill is low, the overall emissions reduction associated with this strategy could be low. On the other hand, people often throw their cups with liquid still in them in the trash and the sheer volume of cups could add up to large totals.

4.8.5 Reduce junk mail coming to campus

Reducing junk mail would reduce the number of trees harvested, energy to process wood into paper, color inks and other chemicals used to prepare and treat that mail, and, finally, the transportation emissions needed to deliver junk mail. This strategy would result in less unsolicited mail coming to campus. Even though junk mail can be recycled, often it is not. Paper weight is heavy and this could result in a modest reduction (1 to 10%) in the amount of landfill waste and associated tipping fees and emissions. This initiative is incorporated into the Green Office Program.

Milestone:
Continue to encourage and help administrative assistants and department managers to reduce unsolicited mail coming to campus.

4.8.6 Encourage paperless courses

An estimated 45% of all printouts are disposed of by the end of the day. Distributing class readings, assignments, and final reports encourage printing behavior throughout Colgate's academic programs. Paperless courses can reduce paper consumption resulting in a modest-to-significant reduction (up to 10%) in landfill tipping fees and greenhouse gas emissions. Encouraging paperless courses would make a good recommendation or best practice for faculty willing to try this on a voluntary basis. Colgate utilizes Blackboard and Moodle, which makes paperless courses possible.

Milestone:
Continue to encourage and help professors and educators reduce unnecessary paper use in the classroom.

4.8.7 Create increased options for students to tour the Madison County landfill, volunteer for the end-of-the-year Salvage program, or spend one shift working with the B&G crew on their recycling run

Creating opportunities for students and employees to learn more about our waste management and recycling practices on campus would increase awareness and potentially improve recycling rates. Not only would this help to create better environmental stewards, but could result in a modest-to-significant reduction (up to 10%) in landfill tipping fees and reduced greenhouse gas emissions. One way to implement this would be to make these options part of our Green Living and Green Office Programs. Students and employees can be given points/credits for participating in any sustainability tour that we offer.

Milestone:
Offer annual trips for employees and students to learn about our waste management and recycling practices on campus and in our county.

4.8.8 Reduce bottled-water consumption on campus

Americans use about 50 billion plastic water bottles each year. However, the recycling rate for plastic in the country is only 23%, which means 38 billion plastic water bottles—more than $1 billion worth of plastic—are contaminating our environment each year. Additionally, water in bottles is much more expensive than water from the tap and there is little proof that bottled water is cleaner or safer[28]. At Colgate, Environmental Health and Safety perform domestic water supply samples on campus several times a month and the results are sent to the Madison County Department of Health on a monthly basis. There have been no samples that exceeded regulatory threshold quantities for any monitored criteria established by the EPA or NYS DEC. From a greenhouse gas perspective, reducing the consumption of bottled water on campus would likely have a small-to-modest reduction (1 to 10%) in landfill waste by weight and associated greenhouse gas emissions. However, reducing the purchase of bottled water on campus could save the university money while avoiding environmental contamination. Perhaps the best approach to encouraging a reduction in the purchase of bottled water on campus would be to undertake an educational campaign while beginning to put infrastructure (e.g., gooseneck refillable water stations) in place to accommodate reusable bottles.

Milestone:
During 2012, we continue to encourage community members and event planners/organizers to look for other options besides purchasing or providing bottled water.

4.9 WATER CONSERVATION AND PROTECTION

In 2010, Colgate University used 85.5 million gallons of potable water costing $926,517 in utilities. That is enough water for every faculty, staff, and student to drink 1,006 glasses of water every day.

Current practices and recent accomplishments:

- Ongoing program to identify and replace standard-flow shower heads, sink faucets, toilets, and urinals with water-saver low-flow devices in dorms and public restrooms.
- Watering the artificial turf of Tyler's Field for field hockey practices uses approximately 210,000 gallons of water annually.
- In 2010, Colgate replaced the last 21 top-loading washing machines with high-efficiency, ENERGY STAR front-loading washers. All washers on campus are now water- and energy-efficient models saving the university money and reducing our ecological footprint. Colgate's old top-loading units used 30 gallons of water per cycle while the new front-loading machines use only 14.8 gallons per cycle. On average, front-loading washers use between 40-75% less water and 30-85% less energy than typical top-loaders.

4.9.1 Install low-flow showerheads in first- and second-year housing

Change all current 2.5 gallon per minute (gpm) showerheads with 1.5 gpm showerheads in first-year and second-year housing. This project is broken down into two phases.

[28] Natural Resources Defense Council. *Bottled-water: Pure Drink or Pure Hype?* Accessed online on January 28, 2010 at: http://www.nrdc.org/water/drinking/bw/exesum.asp.

Milestone:
By 2013, we will have replaced 335 2.5 gpm showerheads in first- and second-year housing with 1.5 gpm low-flow showerheads.

Metrics and Timeline:
This project will be implemented in two phases:

- FY 2012: Phase 1 – first-year housing (Andrews, Curtis, East, Gate House, Stillman, West).
- FY 2013: Phase 2 – second-year housing (Bryan Complex, Cutten Complex, Drake, Townhouses).

Recommended Action:

1. Select brand and model of low-flow showerhead as campus standard and procure the selection.
2. During 2012, we select models and begin piloting in a few select locations.
3. B&G staff installs first round of new showerheads during Fiscal Year 2012 (summer of 2011).

Lead Responsibility:
Colgate's plumber, foreperson, Sustainability Office.

Table 33. *Low-flow showerhead project with estimated cost savings and greenhouse gas reductions.*

MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	FIRST-YEAR NET COST/SAVINGS	FIVE-YEAR NET COST/SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	$/MTeCO2
Low-flow showerheads (first-year housing)	$ 3,900	$ -	$ (28,100)	$ (24,200)	$ (136,600)	0.1	49.0	$ (2,788)
Low-flow showerheads (second-year housing)	$ 5,900	$ -	$ (23,800)	$ (17,900)	$ (113,100)	0.2	41.0	$ (2,757)
TOTALS	**$ 9,800**	**$ -**	**$ (51,900)**	**$ (42,100)**	**$ (249,700)**	**0.2**	**90**	**$ (2,774)**

Table 34. *Low-flow showerhead phase 1 and phase 2 project overview.*

RESIDENCE HALL	COST OF NEW SHOWERHEADS	COST OF LABOR	VOLUME OF WATER SAVED (gallons/year)	WATER: ANNUAL COST SAVINGS	FUEL OIL SAVED (gallons/year)	FUEL OIL: ANNUAL COST SAVINGS	FIRST-YEAR COST SAVINGS	FIVE-YEAR COST SAVINGS	MTeCO2 AVOIDED (annual)
ANDREWS	$ 320	$ 150	281,700	$ (3,100)	600	$ (1,200)	$ (3,830)	$ (21,030)	7
BRYAN COMPLEX	$ 820	$ 390	456,100	$ (4,900)	1,000	$ (2,000)	$ (5,690)	$ (33,290)	12
CURTIS	$ 800	$ 370	521,000	$ (5,600)	1,200	$ (2,400)	$ (6,830)	$ (38,830)	14
CUTTEN COMPLEX	$ 1,200	$ 560	491,900	$ (5,300)	1,100	$ (2,200)	$ (5,740)	$ (35,740)	13
DRAKE	$ 700	$ 330	409,200	$ (4,400)	900	$ (1,800)	$ (5,170)	$ (29,970)	11
EAST	$ 340	$ 160	248,200	$ (2,700)	600	$ (1,200)	$ (3,400)	$ (19,000)	7
GATE HOUSE	$ 480	$ 230	178,900	$ (1,900)	400	$ (800)	$ (1,990)	$ (12,790)	5
STILLMAN	$ 480	$ 230	315,300	$ (3,400)	700	$ (1,400)	$ (4,090)	$ (23,290)	8
TOWNHOUSES	$ 1,320	$ 620	187,800	$ (2,000)	400	$ (800)	$ (860)	$ (12,060)	5
WEST	$ 240	$ 110	279,500	$ (3,000)	600	$ (1,200)	$ (3,850)	$ (20,650)	7
TOTAL	**$ 6,700**	**$ 3,150**	**3,369,600**	**$ (36,300)**	**7,500**	**$ (15,000)**	**$ (41,450)**	**$ (246,650)**	**88**

4.9.2 Reduce watering of artificial turf

The watering of Tyler's field for field hockey practices has a negative environmental image and uses approximately 210,000 gallons of water annually. Tyler's Field is artificial turf designed specifically to drain large amounts of water rapidly, but field hockey often has the field watered prior to practices in order to promote better "playability." Gas-powered water wheels are put into place and run prior to the team taking the field for a significant amount of time in order to make it wet enough to have any significant impact. This policy requires a tremendous amount of water and labor to achieve, especially if the weather is promoting the evaporation process. In many cases, the watering impact doesn't last very long. Although this is an NCAA requirement for games, we could eliminate this environmentally wasteful policy for practice sessions. Eliminating this wasteful procedure for practice sessions would reduce the amount of annual water usage by about 210,000 gallons. This would be a step in the right direction toward promoting greener policies in this realm. The biggest political barrier may come from the field hockey staff, but from a public perspective, it

would be readily accepted to cease this practice. If we can gain acceptance from the staff to eliminate this from at least practices, it would have a measurable impact.

Milestone:
By 2013, we will save money and water by reducing the unnecessary watering of turf at Tyler's Field.

4.10 CLIMATE ACTION PLAN

A key requirement and landmark accomplishment of the American College and University Presidents' Climate Commitment (ACUPCC) is completing the institutional Climate Action Plan. At the time of this writing, nearly 670 presidents and chancellors have committed their institutions to climate neutrality under the ACUPCC and 402 Climate Actions Plans have been completed. Colgate's Climate Action Plan incorporates each of the mitigation projects identified in the Operational Plan of this report that will reduce greenhouse gas emissions. With the publication of this report, we have accomplished this key objective and created a road map that will guide our efforts in the coming years.

4.10.1 ACUPCC requirements

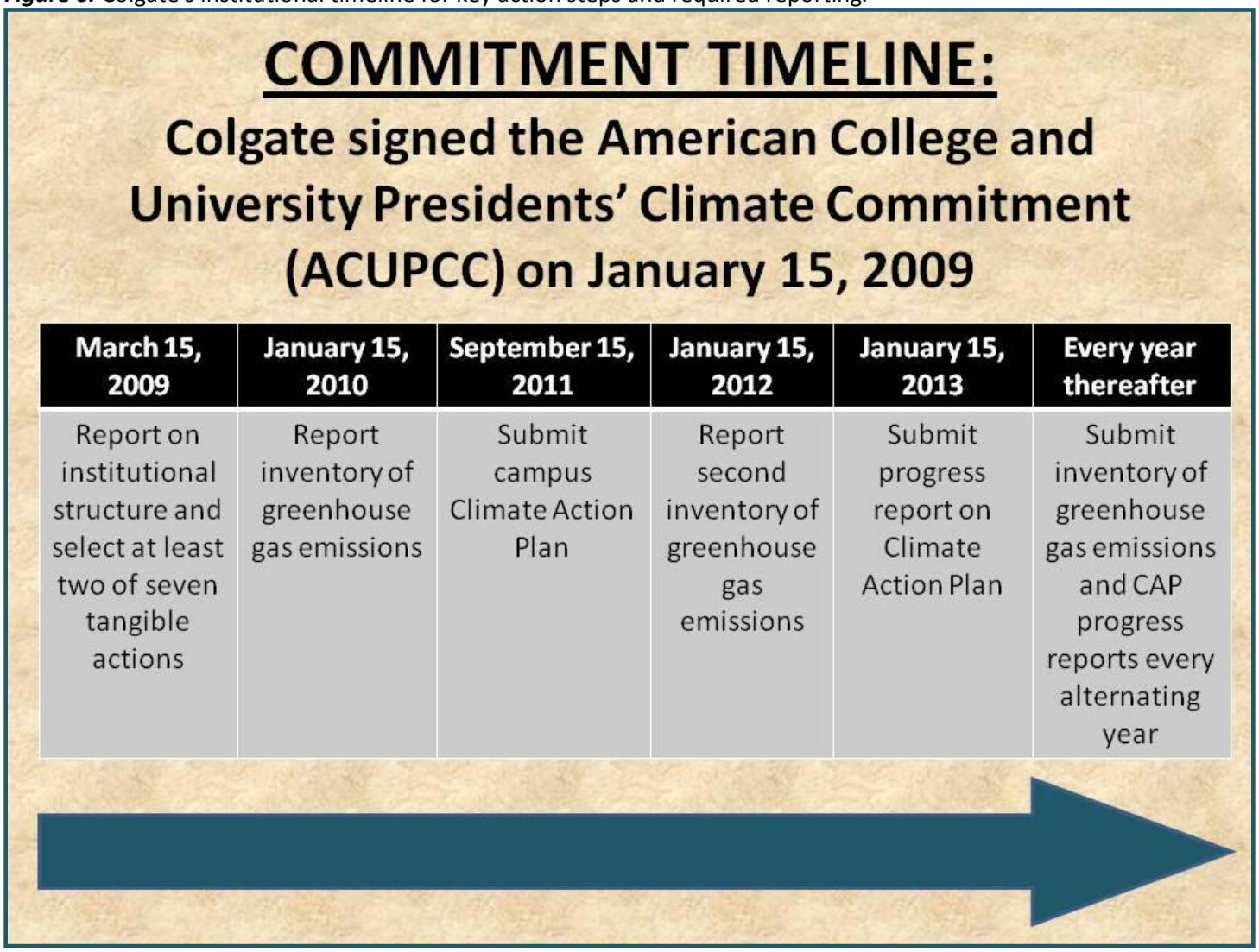
As a signatory to the American College and University Presidents' Climate Commitment, Colgate University has made a commitment to:

- Achieve climate neutrality "*as soon as possible.*" Climate neutrality is defined by ACUPCC as "*…having no net greenhouse gas (GHG) emissions, to be achieved by eliminating net GHG emissions, or by minimizing GHG emissions as much as possible, and using carbon offsets or other measures to mitigate the remaining emissions."*[29]
- Provide the educational opportunity and framework for Colgate students to study, research, and address the climate challenge by reducing global warming emissions and by integrating sustainability into our curriculum.
- Exercise leadership in our community and throughout society by modeling ways to minimize global warming emissions.
- Create institutional structures to guide the development and implementation of the plan.
- Immediately implement at least two tangible actions (from a list of seven) aimed at mitigating Colgate's greenhouse gas emissions.
- Complete a comprehensive inventory of all greenhouse gas emissions and update the inventory every other year thereafter.
- Develop an institutional climate action plan (CAP) that serves as a road map to climate neutrality.
- Make the action plan, inventory, and periodic progress reports publicly available by submitting them to the ACUPCC Reporting System for posting and dissemination.

See Figure 6 for an overview of Colgate's due dates for key action steps and required reporting.

[29] http://www.presidentsclimatecommitment.org/about/faqs#10

Figure 6. Colgate's institutional timeline for key action steps and required reporting.



4.10.2 Achieving climate neutrality: goals and emissions target

Colgate University is a leader among higher education institutions pursuing climate neutrality. Second Nature recognized Colgate's efforts as a 2011 Climate Leadership Award recipient during the Climate Leadership Summit in Washington, D.C.[30] With our wood-fired boiler, low-carbon electricity grid, sustainability-focused academic programming, and a campus culture conducive to sustainability, Colgate is well-positioned to be a continued leader in sustainability in the 21st century.

As expected, Colgate has set an ambitious target date of 2019 for achieving climate neutrality. However, meeting this goal will require the purchase of a substantial number of carbon offsets (Figure 7). As a result, our climate action planning efforts will continue well beyond our climate neutrality date as we continue to implement projects and policies that will reduce our campus's gross emissions and, therefore, our dependency on carbon offsets. In light of this, the University established complementary goals to reduce our gross emissions in the interim:

- By 2015, reduce gross greenhouse gas emissions to 11,249 MTeCO2 or 35% below the 2009 baseline.
- By 2020, reduce gross greenhouse gas emissions to 10,412 MTeCO2 or 40% below the 2009 baseline.

[30] http://secondnaturebos.wordpress.com/2011/06/23/colgate-university-recognized-for-climate-leadership/

Figure 7 is a wedges graph of Colgate's anticipated emissions with the implementation of the mitigation projects highlighted in this report. Each wedge in Figure 7 contains projects that will reduce emissions within that category: behavior change, energy and green building, land use and grounds maintenance, solid waste and recycling, transportation, and offset projects. The black line at the top of the graph—delineating the business-as-usual scenario—represents Colgate's estimated emissions if the university took no specific actions to reduce greenhouse gas emissions.

Figure 7. Colgate's Wedges Analysis: greenhouse gas emissions and sources of reduction.

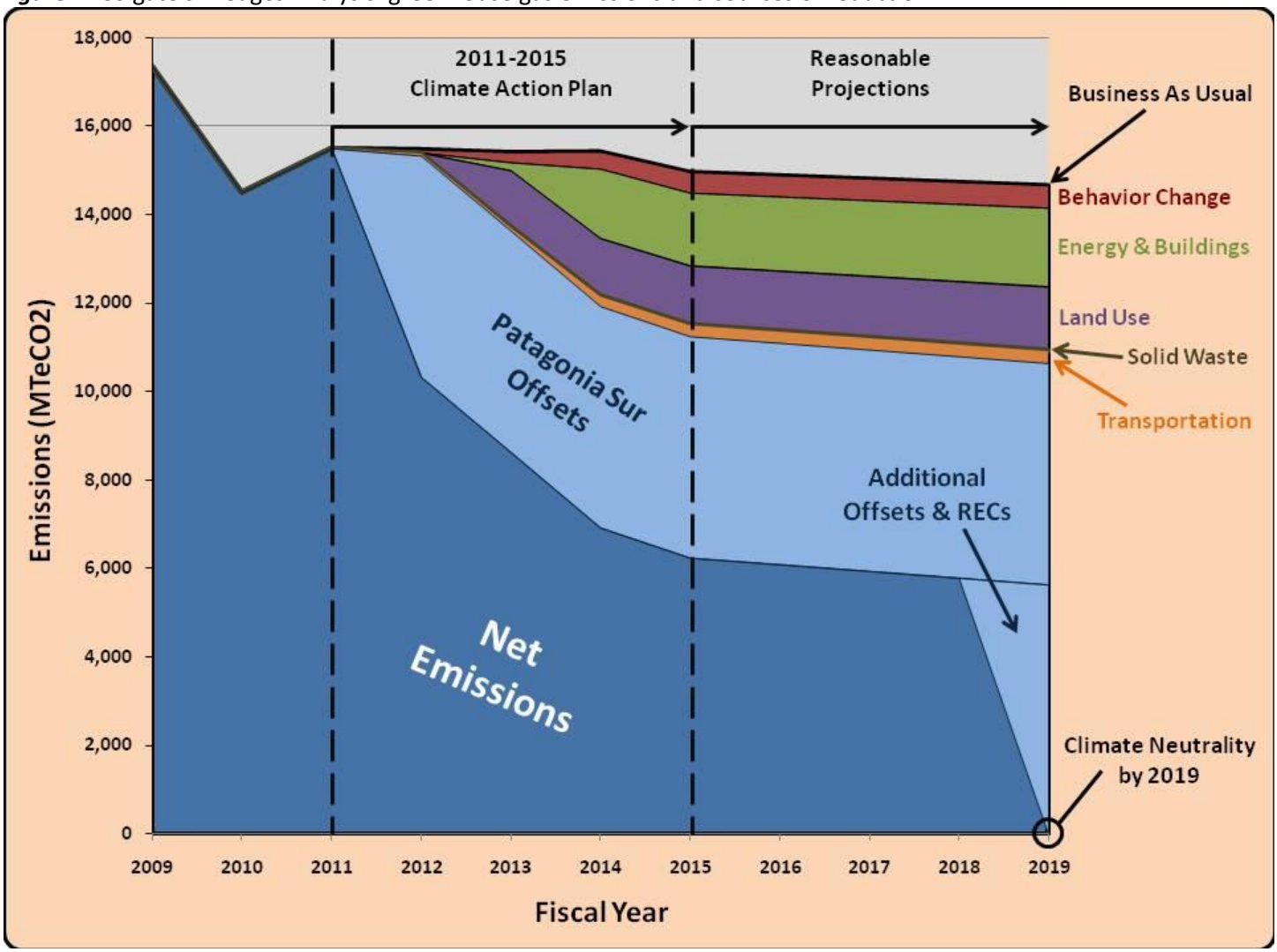


Table 35 identifies sources of reduction as detailed in the Operational Plan. These reductions total 3,703 MTeCO2 by 2015 or a 25% reduction of business-as-usual emissions.

Table 35. *Annual greenhouse gas reductions by source and percent reduction off a business-as-usual scenario.*

EMISSIONS REDUCTION STRATEGY	MTeCO2 REDUCED				TOTAL % REDUCTION OF BAU EMISSIONS
Behavior Change	**2012**	**2013**	**2014**	**2015**	
Green Office Program	47	47	47	47	1.3%
Green Living Program	21	109	112	34	1.8%
Green events: waste minimization and recycling	2	0	0	0	0.0%
TOTAL	**70**	**156**	**159**	**81**	**3.1%**
Energy and Buildings	**2012**	**2013**	**2014**	**2015**	
Sanford Field House (energy conservation measures)	0	35	0	0	0.2%
Olin Hall (energy conservation measures)	0	92	0	0	0.6%
McGregory Hall (energy conservation measures)	0	0	60	0	0.4%
Low-flow showerheads	49	41	0	0	0.6%
Adaptive computer power management	0	0	23	0	0.2%
Fuel switching: eliminate fuel oil #6	0	0	1,258	0	8.4%
Solar thermal energy	0	0	6	0	0.0%
Wind energy	0	0	0	2	0.0%
Geothermal heat exchange	0	0	0	72	0.5%
TOTAL	**49**	**168**	**1,347**	**74**	**11.0%**
Land Use and Grounds Maintenance	**2012**	**2013**	**2014**	**2015**	
Establish 'reduced mow' areas (30 acres)	4	2	0	0	0.0%
Forest sequestration (carbon accounting project)	0	1,239	0	0	8.3%
Reforestation (8 acres)	8	16	24	32	0.5%
TOTAL	**12**	**1,257**	**24**	**32**	**8.9%**
Solid Waste and Purchasing	**2012**	**2013**	**2014**	**2015**	
Trayless dining operations (Frank Dining Hall)	0	2	0	0	0.0%
Paper purchasing policy (eliminate non-recycled paper)	3	0	0	0	0.0%
$50 minimum purchasing order	1	0	0	0	0.0%
On-site composting (pre- and post-consumer)	8	13	0	0	0.1%
TOTAL	**12**	**15**	**0**	**0**	**0.2%**
Transportation	**2012**	**2013**	**2014**	**2015**	
Encourage flexible working schedules	0	0	21	0	0.1%
Purchase electric vehicles (6)	0	4	4	4	0.1%
Implement 'no-idling' policy	13	0	0	0	0.1%
Purchase hybrid-electric vehicles (3)	0	3	3	3	0.1%
Videoconferencing	0	0	100	0	0.7%
Biodiesel (B20 blend)	11	0	0	0	0.1%
Carpooling (48 carpools)	18	18	18	18	0.5%
Employee bicycle commuting (30 bikes & 10 bike racks)	0	4	4	4	0.1%
TOTAL	**42**	**28**	**150**	**29**	**1.7%**
TOTAL	**184**	**1,624**	**1,679**	**216**	**25%**

Figure 7 and Table 35 illustrate that *Energy and Buildings* (11%) and *Land Use and Grounds Maintenance* (8.9%) will provide the largest chunk of emissions reductions from now until 2015.

4.10.3 Climate Action Plan project prioritization and financial analysis

Colgate University's Climate Action Plan is a year-by-year road map to climate neutrality by 2019. Throughout our climate action planning process, the Climate Action Plan Steering Committee and Subcommittees worked to identify specific projects that could be implemented within the next four years. In the end, we agreed upon 27 projects that will reduce our carbon footprint. Projects range from low-cost, high-impact behavior-change strategies such as the Green Office and Green Living Programs to capital-intensive and technologically complex engineering projects such as the heating plant upgrade (fuel switching from #6 oil to natural gas). Over the next few years, we will strive to implement these proposed projects. While this Climate Action Plan provides us with the blueprint from which to work, we also recognize the importance of remaining flexible. We must remain vigilant to new opportunities and be willing to deviate from our plan when necessary. Like a turn-by-turn dashboard navigator, we must be willing to "recalculate" when a more effective route to climate neutrality emerges.

Table 36 ranks each of the Climate Action Plan mitigation strategies according to the project's cost per MTeCO2 reduced. The first 19 projects on the list will reduce Colgate's greenhouse gas emissions while saving the university money.

Table 36. Climate Action Plan: *project ranking by cost per ton of greenhouse gases (MTeCO2) reduced.*

RANK	MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	FIVE YEAR $/MTeCO2
1	Encourage flexible work schedules	$ -	$ -	$ -	N/A	21	$ -
2	Trayless dining operations (Frank Dining Hall)	$ 90,000	$ -	$ (100,700)	0.9	2	$ (206,750)
3	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	0.0	3	$ (6,333)
4	Green Office Program (40 new offices; 240 employees)	$ -	$ 2,000	$ (109,900)	0.0	188	$ (2,870)
5	Low-flow showerheads	$ 9,800	$ -	$ (51,900)	0.2	90	$ (2,774)
6	Adaptive computer power management	$ 14,400	$ 2,700	$ (17,000)	1.0	23	$ (2,531)
7	$50 minimum purchasing order	$ -	$ -	$ (500)	0.0	1	$ (2,500)
8	Purchase electric vehicles (6)	$ 9,000	$ -	$ (6,600)	1.4	11	$ (2,176)
9	Implement 'no-idling' policy	$ 1,000	$ -	$ (5,200)	0.2	13	$ (1,996)
10	Sanford Field House (energy conservation measures)	$ 64,500	$ -	$ (25,600)	2.5	35	$ (1,804)
11	Green events: waste minimization and recycling	$ -	$ -	$ (600)	0.0	2	$ (1,500)
12	Establish 'reduced mow' areas (30 acres)	$ 1,800	$ -	$ (1,800)	1.0	6	$ (1,200)
13	Purchase hybrid-electric vehicles (3)	$ 6,000	$ -	$ (3,000)	2.0	9	$ (961)
14	Green Living Program	$ 38,300	$ 45,500	$ (104,700)	0.8	276	$ (934)
15	On-site composting (pre- and post-consumer)	$ 7,000	$ 4,100	$ (8,100)	1.4	21	$ (619)
16	Videoconferencing	$ 35,200	$ -	$ (19,000)	1.9	100	$ (598)
17	Olin Hall (energy conservation measures)	$ 148,300	$ -	$ (34,700)	4.3	92	$ (274)
18	Biodiesel (B20 blend)	$ -	$ -	$ (500)	0.0	11	$ (227)
19	McGregory Hall (energy conservation measures)	$ 96,900	$ -	$ (21,500)	4.5	60	$ (175)
20	Forest sequestration (carbon accounting project)	$ 30,000	$ -	$ -	N/A	1,239	$ 24
21	Carpooling (48 carpools)	$ -	$ 500	$ -	N/A	72	$ 35
22	Reforestation of open spaces (8 acres)	$ 5,400	$ -	$ -	N/A	80	$ 68
23	Geothermal heat exchange	$ 125,000	$ -	$ (15,000)	8.3	72	$ 697
24	Employee bicycle commuting (30 bikes & 10 bike racks)	$ 8,500	$ 5,100	$ -	N/A	12	$ 2,931
25	Solar thermal energy	$ 27,500	$ -	$ (1,300)	21.2	6	$ 3,573
26	Fuel switching: eliminate fuel oil #6	$ 7,300,000	$ -	$ (366,000)	19.9	1,258	$ 4,348
27	Wind energy	$ 86,000	$ -	$ (2,400)	35.8	2	$ 43,529
CLIMATE ACTION PLAN TOTAL		**$ 8,105,000**	**$ 60,000**	**$ 914,000**	**9.1**	**3,700**	**$ 1,055**

Table 37 ranks each of the Climate Action Plan mitigation strategies according to the project's total MTeCO2 reduced. The first 11 projects on the list will reduce Colgate's greenhouse gas emissions by over 3,500 MTeCO2 or 95% of all greenhouse gas reductions identified in this plan.

Table 37. Climate Action Plan: *project ranking by total greenhouse gases (MTeCO2) reduced.*

RANK	MITIGATION PROJECT	FIRST COST	ANNUAL OPERATING COST	ANNUAL SAVINGS	SIMPLE PAYBACK (YRS)	MTeCO2 REDUCED	FIVE YEAR $/MTeCO2
1	Fuel switching: eliminate fuel oil #6	$ 7,300,000	$ -	$ (366,000)	19.9	1,258	$ 4,348
2	Forest sequestration (carbon accounting project)	$ 30,000	$ -	$ -	N/A	1,239	$ 24
3	Green Living Program	$ 38,300	$ 45,500	$ (104,700)	0.8	276	$ (934)
4	Green Office Program (40 new offices; 240 employees)	$ -	$ 2,000	$ (109,900)	0.0	188	$ (2,870)
5	Videoconferencing	$ 35,200	$ -	$ (19,000)	1.9	100	$ (598)
6	Olin Hall (energy conservation measures)	$ 148,300	$ -	$ (34,700)	4.3	92	$ (274)
7	Low-flow showerheads	$ 9,800	$ -	$ (51,900)	0.2	90	$ (2,774)
8	Reforestation of open spaces (8 acres)	$ 5,400	$ -	$ -	N/A	80	$ 68
9	Carpooling (48 carpools)	$ -	$ 500	$ -	N/A	72	$ 35
10	Geothermal heat exchange	$ 125,000	$ -	$ (15,000)	8.3	72	$ 697
11	McGregory Hall (energy conservation measures)	$ 96,900	$ -	$ (21,500)	4.5	60	$ (175)
12	Sanford Field House (energy conservation measures)	$ 64,500	$ -	$ (25,600)	2.5	35	$ (1,804)
13	Adaptive computer power management	$ 14,400	$ 2,700	$ (17,000)	1.0	23	$ (2,531)
14	On-site composting (pre- and post-consumer)	$ 7,000	$ 4,100	$ (8,100)	1.4	21	$ (619)
15	Encourage flexible work schedules	$ -	$ -	$ -	N/A	21	$ -
16	Implement 'no-idling' policy	$ 1,000	$ -	$ (5,200)	0.2	13	$ (1,996)
17	Employee bicycle commuting (30 bikes & 10 bike racks)	$ 8,500	$ 5,100	$ -	N/A	12	$ 2,931
18	Purchase electric vehicles (6)	$ 9,000	$ -	$ (6,600)	1.4	11	$ (2,176)
19	Biodiesel (B20 blend)	$ -	$ -	$ (500)	0.0	11	$ (227)
20	Purchase hybrid-electric vehicles (3)	$ 6,000	$ -	$ (3,000)	2.0	8	$ (1,076)
21	Establish 'reduced mow' areas (30 acres)	$ 1,800	$ -	$ (1,800)	1.0	6	$ (1,200)
22	Solar thermal energy	$ 27,500	$ -	$ (1,300)	21.2	6	$ 3,573
23	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	0.0	3	$ (6,333)
24	Green events: waste minimization and recycling	$ -	$ -	$ (600)	0.0	2	$ (1,500)
25	Trayless dining operations (Frank Dining Hall)	$ 90,000	$ -	$ (100,700)	0.9	2	$ (206,750)
26	Wind energy	$ 86,000	$ -	$ (2,400)	35.8	2	$ 43,529
27	$50 minimum purchasing order	$ -	$ -	$ (500)	0.0	1	$ (2,500)
CLIMATE ACTION PLAN TOTAL		**$ 8,105,000**	**$ 60,000**	**$ 914,000**	**9.1**	**3,700**	**$ 1,055**

Some of the goals and projects in this report make good sense because they advance sustainability on campus and may reduce operating costs (e.g., dining operations, composting, water management, procurement, and others) even though they may have little to no overall effect on the campus carbon footprint. Table 38 provides a complete overview of the financial impacts and estimated greenhouse gas reductions for each project by fiscal year. The Sustainability and Climate Action Plan has a one-time implementation cost of $8.1 million (with the heating plant upgrade project costing $7.3 million) and a cumulative operating cost of over $400,000. On the flip side, we anticipate that Colgate will avoid spending over $2 million in operating costs between 2012 and 2015 with the implementation of this plan while avoiding over 35,500 tons of greenhouse gas emissions (Table 38).

Table 38. *Financial analysis and estimated greenhouse gas reductions for each project by fiscal year.*

FISCAL YEAR 2012 MITIGATION PROJECTS		FIRST COST	OPERATING COST	AVOIDED SPENDING	NET COST/SAVINGS	AVOIDED EMISSIONS (MTeCO2)
4.1.1	Green Office Program (10 new offices; 60 employees)	$ -	$ 2,000	$ (27,500)	$ (25,500)	47
4.1.2	Green Living Program (Eco-Olympics & RecycleMania)	$ -	$ 4,100	$ (5,800)	$ (1,700)	21
4.1.3	Green events: waste minimization and recycling	$ -	$ -	$ (600)	$ (600)	2
4.4.1	Establish 'reduced mow' areas (20 acres)	$ 1,200	$ -	$ (1,200)	$ -	4
4.4.2	Reforestation of open spaces (2 acres)	$ 1,500	$ -	$ -	$ 1,500	8
4.5.4	$50 minimum purchasing order	$ -	$ -	$ (500)	$ (500)	1
4.5.5	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	$ (3,800)	3
4.6.1	Carpooling (12 new carpools)	$ -	$ 500	$ -	$ 500	18
4.6.9	Biodiesel (B20 blend)	$ -	$ -	$ (500)	$ (500)	11
4.6.10	Implement 'no-idling' policy	$ 1,000	$ -	$ (5,200)	$ (4,200)	13
4.8.1	On-site composting (pre-consumer)	$ 7,000	$ 4,100	$ (3,100)	$ 8,000	8
4.9.1	Low-flow showerheads (first-year housing)	$ 3,900	$ -	$ (28,100)	$ (24,200)	49
4.10.4	Carbon offsets	$ -	$ 50,000	$ -	$ 50,000	5,000
FY 2012 TOTAL		**$ 14,600**	**$ 60,700**	**$ (76,300)**	**$ (1,000)**	**5,183**

FISCAL YEAR 2013 MITIGATION PROJECTS		FIRST COST	OPERATING COST	AVOIDED SPENDING	NET COST/SAVINGS	AVOIDED EMISSIONS (MTeCO2)
4.1.1	Green Office Program (10 new offices; 60 employees)	$ -	$ 2,000	$ (55,000)	$ (53,000)	94
4.1.2	Green Living Program (first-year housing)	$ 29,800	$ 23,100	$ (42,600)	$ 10,300	130
4.1.3	Green events: waste minimization and recycling	$ -	$ -	$ (600)	$ (600)	2
4.2.5	Sanford Field House (energy conservation measures)	$ 64,500	$ -	$ (25,600)	$ 38,900	35
4.2.6	Olin Hall (energy conservation measures)	$ 148,300	$ -	$ (34,600)	$ 113,700	92
4.3.1	Trayless dining operations (Frank Dining Hall)	$ 90,000	$ -	$ (100,700)	$ (10,700)	2
4.4.1	Establish 'reduced mow' areas (30 acres)	$ 600	$ -	$ (1,700)	$ (1,100)	6
4.4.2	Reforestation of open spaces (2 acres)	$ 1,300	$ -	$ -	$ 1,300	16
4.4.3	Forest sequestration (carbon accounting project)	$ 30,000	$ -	$ -	$ 30,000	1,239
4.5.4	$50 minimum purchasing order	$ -	$ -	$ (500)	$ (500)	1
4.5.5	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	$ (3,800)	3
4.6.1	Carpooling (12 new carpools)	$ -	$ 500	$ -	$ 500	36
4.6.2	Employee bicycle commuting (10 bikes & bike racks)	$ 4,500	$ 5,100	$ -	$ 9,600	4
4.6.7	Purchase electric vehicles (2)	$ 3,000	$ -	$ (2,200)	$ 800	4
4.6.8	Purchase hybrid-electric vehicle (1)	$ 2,000	$ -	$ (1,000)	$ 1,000	3
4.6.9	Biodiesel (B20 blend)	$ -	$ -	$ (500)	$ (500)	11
4.6.10	Implement 'no-idling' policy	$ -	$ -	$ (5,200)	$ (5,200)	13
4.8.1	On-site composting (pre- and post-consumer)	$ -	$ 4,100	$ (8,100)	$ (4,000)	21
4.9.1	Low-flow showerheads (first- and second-year housing)	$ 5,900	$ -	$ (51,900)	$ (46,000)	90
4.10.4	Carbon offsets	$ -	$ 50,000	$ -	$ 50,000	5,000
FY 2013 TOTAL		**$ 379,900**	**$ 84,800**	**$ (334,000)**	**$ 130,700**	**6,802**

Table 38. *Continued.*

FISCAL YEAR 2014 MITIGATION PROJECTS		FIRST COST	OPERATING COST	AVOIDED SPENDING	NET COST/SAVINGS	AVOIDED EMISSIONS (MTeCO2)
4.1.1	Green Office Program (10 new offices; 60 employees)	$ -	$ 2,000	$ (82,400)	$ (80,400)	141
4.1.2	Green Living Program (second-year housing)	$ 8,500	$ 33,200	$ (79,200)	$ (37,500)	242
4.1.3	Green events: waste minimization and recycling	$ -	$ -	$ (600)	$ (600)	2
4.2.1	Fuel switching: eliminate fuel oil #6	$ 7,300,000	$ -	$ (366,000)	$ 6,934,000	1,258
4.2.3	Solar thermal energy	$ 27,500	$ -	$ (1,300)	$ 26,200	6
4.2.5	Sanford Field House (energy conservation measures)	$ -	$ -	$ (51,200)	$ (51,200)	35
4.2.6	Olin Hall (energy conservation measures)	$ -	$ -	$ (69,400)	$ (69,400)	92
4.2.7	McGregory Hall (energy conservation measures)	$ 96,800	$ -	$ (21,500)	$ 75,300	60
4.2.8	Adaptive computer power management	$ 14,400	$ 2,700	$ (17,000)	$ 100	23
4.3.1	Trayless dining operations (Frank Dining Hall)	$ -	$ -	$ (100,700)	$ (100,700)	2
4.4.1	Establish 'reduced mow' areas (30 acres)	$ -	$ -	$ (1,800)	$ (1,800)	6
4.4.2	Reforestation of open spaces (2 acres)	$ 1,300	$ -	$ -	$ 1,300	24
4.4.3	Forest sequestration (carbon accounting project)	$ -	$ -	$ -	$ -	1,239
4.5.4	$50 minimum purchasing order	$ -	$ -	$ (500)	$ (500)	1
4.5.5	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	$ (3,800)	3
4.6.1	Carpooling (12 new carpools)	$ -	$ 500	$ -	$ 500	54
4.6.2	Employee bicycle commuting (10 new bikes)	$ 2,000	$ 5,100	$ -	$ 7,100	8
4.6.4	Encourage flexible work schedules	$ -	$ -	$ -	$ -	21
4.6.7	Purchase electric vehicles (2)	$ 3,000	$ -	$ (4,500)	$ (1,500)	8
4.6.8	Purchase hybrid-electric vehicle (1)	$ 2,000	$ -	$ (2,000)	$ -	6
4.6.9	Biodiesel (B20 blend)	$ -	$ -	$ (500)	$ (500)	11
4.6.10	Implement 'no-idling' policy	$ -	$ -	$ (5,200)	$ (5,200)	13
4.7.1	Videoconferencing	$ 35,200	$ -	$ (19,000)	$ 16,200	100
4.8.1	On-site composting (pre- and post-consumer)	$ -	$ 4,100	$ (8,100)	$ (4,000)	21
4.9.1	Low-flow showerheads (first- and second-year housing)	$ -	$ -	$ (51,900)	$ (51,900)	90
4.10.4	Carbon offsets	$ -	$ 50,000	$ -	$ 50,000	5,000
FY 2014 TOTAL		**$ 7,490,700**	**$ 97,600**	**$ (886,600)**	**$6,701,700**	**8,466**

Table 38. *Continued.*

FISCAL YEAR 2015 MITIGATION PROJECTS		FIRST COST	OPERATING COST	AVOIDED SPENDING	NET COST/SAVINGS	AVOIDED EMISSIONS (MTeCO2)
4.1.1	Green Office Program (10 new offices; 60 employees)	$ -	$ 2,000	$ (109,900)	$ (107,900)	188
4.1.2	Green Living Program (townhouses and apartments)	$ -	$ 45,500	$ (104,700)	$ (59,200)	276
4.1.3	Green events: waste minimization and recycling	$ -	$ -	$ (600)	$ (600)	2
4.2.1	Fuel Switching: Fuel Oil #6 replaced by Natural Gas	$ -	$ -	$ (366,000)	$ (366,000)	1,258
4.2.2	Wind energy	$ 86,000	$ -	$ (2,400)	$ 83,600	2
4.2.3	Solar thermal energy	$ -	$ -	$ (1,300)	$ (1,300)	6
4.2.4	Geothermal heat exchange	$ 125,000	$ -	$ (15,000)	$ 110,000	72
4.2.5	Sanford Field House (energy conservation measures)	$ -	$ -	$ (76,900)	$ (76,900)	35
4.2.6	Olin Hall (energy conservation measures)	$ -	$ -	$ (104,000)	$ (104,000)	92
4.2.7	McGregory Hall (energy conservation measures)	$ -	$ -	$ (21,500)	$ (21,500)	60
4.2.8	Adaptive computer power management	$ -	$ 2,700	$ (17,000)	$ (14,300)	23
4.3.1	Trayless dining operations (Frank Dining Hall)	$ -	$ -	$ (100,700)	$ (100,700)	2
4.4.1	Establish 'reduced mow' areas (30 acres)	$ -	$ -	$ (1,800)	$ (1,800)	6
4.4.2	Reforestation of open spaces (2 acres)	$ 1,300	$ -	$ -	$ 1,300	32
4.4.3	Forest sequestration (carbon accounting project)	$ -	$ -	$ -	$ -	1,239
4.5.4	$50 minimum purchasing order	$ -	$ -	$ (500)	$ (500)	1
4.5.5	Paper purchasing policy (eliminate non-recycled paper)	$ -	$ -	$ (3,800)	$ (3,800)	3
4.6.1	Carpooling (12 new carpools)	$ -	$ 500	$ -	$ 500	72
4.6.2	Employee bicycle commuting (10 new bikes)	$ 2,000	$ 5,100	$ -	$ 7,100	12
4.6.4	Encourage flexible work schedules	$ -	$ -	$ -	$ -	21
4.6.7	Purchase electric vehicles (2)	$ 3,000	$ -	$ (6,700)	$ (3,700)	12
4.6.8	Purchase hybrid-electric vehicle (1)	$ 2,000	$ -	$ (3,000)	$ (1,000)	9
4.6.9	Biodiesel (B20 blend)	$ -	$ -	$ (500)	$ (500)	11
4.6.10	Implement 'no-idling' policy	$ -	$ -	$ (5,200)	$ (5,200)	13
4.7.1	Videoconferencing	$ -	$ -	$ (19,000)	$ (19,000)	100
4.8.1	On-site composting (pre- and post-consumer)	$ -	$ 4,100	$ (8,100)	$ (4,000)	21
4.9.1	Low-flow showerheads (first- and second-year housing)	$ -	$ -	$ (51,900)	$ (51,900)	90
4.10.4	Carbon offsets	$ -	$ 98,000	$ -	$ 98,000	11,400
FY 2015 TOTAL		$ 219,300	$157,900	$ (1,020,500)	$ (643,300)	15,057
CLIMATE ACTION PLAN TOTAL (CUMULATIVE)		$ 8,104,500	$401,000	$ (2,317,400)	$6,188,100	35,508

Furthermore, we anticipate that by implementing the cumulative suite of projects identified in this plan, we will reduce our annual operating budget by over $750,000 by 2015 (Table 39).

Table 39. *Climate Action Plan Financial Analysis: annual operating cost, annual operating savings, and net cost/savings by fiscal year.*

PROJECTED OPERATING COST (Cumulative)	2012	2013	2014	2015
ALL PROJECTS (except Heating Plant)	$ 11,000	$ 35,000	$ 48,000	$ 60,000
HEATING PLANT	$ -	$ -	$ -	$ -
CARBON OFFSET PURCHASES (Inc. Patagonia Sur)	$ 50,000	$ 50,000	$ 50,000	$ 98,000
TOTAL	**$ 61,000**	**$ 85,000**	**$ 98,000**	**$ 158,000**

PROJECTED SAVINGS (Cumulative)	2012	2013	2014	2015
ALL PROJECTS (except Heating Plant)	$ (76,000)	$ (334,000)	$ (469,000)	$ (548,000)
HEATING PLANT	$ -	$ -	$ (366,000)	$ (366,000)
TOTAL	$(76,000)	$(334,000)	$(835,000)	$(914,000)

NET OPERATING COST/(SAVINGS)	2012	2013	2014	2015
ALL PROJECTS (except Heating Plant)	$ (65,000)	$ (299,000)	$ (421,000)	$ (488,000)
HEATING PLANT	$ -	$ -	$ (366,000)	$ (366,000)
CARBON OFFSET PURCHASES (Inc. Patagonia Sur)	$ 50,000	$ 50,000	$ 50,000	$ 98,000
TOTAL	**$(15,000)**	**$(249,000)**	**$(737,000)**	**$(756,000)**

With this financial analysis in place, we can budget accordingly to ensure that the Sustainability and Climate Action Plan is implemented on schedule. Throughout the implementation period, each project will be considered on a case-by-case basis during each fiscal year before funding becomes available. This will ensure that we remain vigilant to new opportunities and continue to properly evaluate each project before moving forward.

4.10.4 Carbon Offsets

A carbon offset is the reduction, removal, or avoidance of greenhouse gases (eCO2) from the atmosphere that serve as a counterbalance to emissions from other activities. Carbon offset projects come in many forms but generally fall into two broad categories: 1) projects that reduce or avoid emissions, such as the installation of a wind park to replace a coal-fired energy plant, and 2) projects that sequester or remove greenhouse gases from the atmosphere, such as planting trees that absorb atmospheric carbon as they grow.

In Colgate's case, we can "offset" some of our gross emissions by investing in off-campus projects that effectively mitigate atmospheric greenhouse gases. This is a legitimate second option to reducing on-campus emissions since with regard to global climate change it does not matter where on earth emissions are generated or sequestration is enhanced: the effect on global climate change is the same. Thus, if Colgate chooses to acknowledge the harm done by its own operations, it can do so by 1) reducing emissions on campus or by 2) reducing emissions elsewhere, that is, through the purchase of legitimate carbon offsets.

While implementing on-campus projects that reduce Colgate's gross emissions is Colgate's top priority, the university must invest in carbon offsets to achieve climate neutrality by 2019. Significant emissions sources such as air travel, commuting, and some forms of energy use are currently impossible to eliminate without extraordinary disruption to our academic mission. Since it will be impossible to mitigate all of Colgate’s on-campus emissions in the foreseeable future, purchasing offsets to achieve climate neutrality demonstrates that the university accepts responsibility for the harmful effects its operations cause on global climate change. Purchasing offsets could also spur mitigation efforts by creating a financial incentive for mitigation that would reduce the need to purchase future offsets.

The voluntary offsets market is mature with generally agreed-upon standards. Colgate can be confident that if it purchases offsets that are certified by one of several well-known institutions (e.g., Verified Carbon Standard), the offsets represent real reductions in global net emissions that would not have occurred without Colgate's financing. The process of validating offset projects can be time consuming and complicated, suggesting that purchases of offsets will likely be more cost-effective than if Colgate initiated its own emission reduction or sequestration projects, notwithstanding possible academic benefits and benefits to the local economy.

That said, we are especially interested in local offset projects. Presently, local options are generally small scale, more expensive, and could take years to develop and implement. Nevertheless, local offset projects remain an exciting option that we will actively explore in the coming months and years.

Patagonia Sur

In FY 2012, Colgate entered into an agreement with Patagonia Sur[31] for the purchase of 5,000 tons of offsets per year for 15 years at $10 per ton. The project is a reforestation project in The Patagonia Sur Nature Reserve in the Palena province of southern Chile. Over the course of 15 years, approximately 225,000 native trees will be planted on roughly 428 acres of land which will become the Colgate University Forest. The Patagonia Sur reforestation project is acquiring Verified Carbon Standard (VCS) certification. Importantly, the agreement creates academic opportunities for students and faculty to conduct research within the Colgate Forest and The Patagonia Sur Nature Reserve in general.

Renewable Energy Certificates (RECs)

There are two distinct clean energy markets: the market for voluntary emissions reductions (VERs), also known as carbon offsets, and the market for renewable energy certificates (RECs) or green tags. RECs are specifically designed to mitigate Scope 2 emissions from electricity generation and consumption. RECs are characterized by the creation of renewable electricity whereby clean energy production displaces or reduces demand for more traditional carbon-intensive forms of energy. More specifically, RECs represent the environmental benefits (or attributes) received by the displacement of conventional fuel use, such as coal, oil, or gas. One REC is representative of one megawatt-hour of electricity (1,000 kilowatt-hours) and allows the purchaser to support renewable energy production even though they themselves may not use the renewable energy.

Purchasing third-party certified RECs (such as Green-e[32]) can be a cost-effective way for Colgate to mitigate its emissions associated with electricity consumption and presents another promising opportunity for Colgate to support renewable electricity generation while achieving climate neutrality by 2019. This opportunity is ripe for student research.

Currently, a third-party certified REC costs approximately $0.00133 per kWh[33] in the most carbon-intensive region in the United States (the MRO-West grid[34]). Colgate would need to purchase approximately 2,106,000 kWh worth of RECs in order to mitigate our 1,900 MTeCO2 associated with electricity consumption.[35] This would cost the University approximately $2,800.

Assuming Colgate mitigates approximately 1,900 MTeCO2 associated with the University's consumption of electricity by purchasing RECs and Colgate's relationship with Patagonia Sur continues to offset 5,000 MTeCO2 annually, then Colgate

[31] Visit the Patagonia Sur website for more information http://patagoniasur.com/carbon-offsets-overview.php?l=e&l=e.
[32] Green-e Energy certifies renewable energy that meets environmental and consumer protection standards that it developed in conjunction with leading environmental, energy, and policy organizations. To learn more about Green-e certification, visit their website: http://www.green-e.org/getcert_re.shtml.
[33] Quote given by Renewable Choice for their Clean Source (MRO-West) Product on July 19, 2011.
[34] The MRO-West region includes portions of Montana, North Dakota, South Dakota, Nebraska, Minnesota, Wisconsin, and Iowa. Combined, these states are heavily dependent on carbon-intensive coal technologies to produce electricity. A map of the different U.S. electricity grids can be viewed on the EPA website at http://www.epa.gov/greenpower/pubs/calculator.htm.
[35] This was determined using the EPA's Green Power Equivalency Calculator for the MRO-West region. The calculator was accessed from the EPA's website on July 20, 2011 at http://www.epa.gov/greenpower/pubs/calculator.htm.

will be left with approximately 4,500 MTeCO2 to offset in order to achieve climate neutrality. Altogether, Colgate could spend as little as $97,800 in carbon offsets and RECs to achieve climate neutrality (Table 40).

Table 40. *Achieving Climate Neutrality: estimated cost to purchase carbon offsets and RECs to mitigate Colgate's remaining gross emissions.*

OFFSETS	MTeCO2 Mitigated	Cost
Patagonia Sur (Reforestation Project)	5,000	$ 50,000
Offsets on the Voluntary Market	4,500	$ 45,000
Renewable Energy Certificate (REC)	1,900	$ 2,800
FY 2015 TOTAL	11,400	$ 97,800

Alternatively, Colgate could purchase 100% green power to cover all of our electricity consumption. At approximately $0.00096 per kWh, Colgate could purchase 100% green power at a cost of just under $30,000 with a total annual electricity consumption of 31,000,000 kWh.

5.0 ACADEMICS: Curriculum, Research, and Community Engagement
SUSTAINABILITY AND CLIMATE ACTION PLAN

The Sustainability and Climate Action Plan is more than a tactical guide to reducing Colgate's ecological and carbon footprints. The ultimate purpose in everything we do is to provide an exceptional liberal arts education and our sustainability and greenhouse gas reduction efforts are no exception. By integrating sustainability concepts into our curriculum, research, culture, and broader community engagement, we help to prepare students for life and work in the 21st century. Moreover, student work in sustainability supports place-based, experiential learning that fosters a lifetime of engaged citizenship. By nurturing these educational opportunities in sustainability, Colgate will further secure its foothold as an academic institution of excellence while giving our graduates further advantage in the workplace.

5.1 SUSTAINABILITY AND CLIMATE CHANGE IN THE CURRICULUM

The environmental and social challenges of the 21st century are pervasive and will impact the professional careers of every student in college today. Recognizing this, several of the "13 Goals of a Colgate Education" (approved by Colgate faculty serving on the Academic Advisory Board in April 2010) incorporate one or more of the environmental, social, and/or economic dimensions of sustainability. 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 that are either focused on or related to sustainability and/or climate change. Recent examples include courses such as:

- **CORE 123: Climate Change & Human History**
- **ECON 228: Environmental Economics**
- **ENST 202: Environmental Ethics**
- **FSEM 121: The Air Up There**
- **FSEM 124: Global Change and You.** Each FSEM 124 student in the fall of 2010 took on a research project that explored a specific strategy to reduce Colgate's carbon footprint. Research projects included lighting upgrades, cropped biomass, alternative transportation, water efficiency and conservation, and waste reduction and recycling.
- **GEOG 121: Human Impact on the Environment**
- **GEOG 310: Geopolitics**
- **GEOG 320: Globalization, Development & Environment**
- **SOAN 245: Nature, Culture & Politics**

Over the years, **ENST 480 and ENST 390: Community-Based Study of Environmental Issues** have connected Colgate's curriculum with advancing the practice of sustainability on campus and in our community. These project-based, interdisciplinary courses examine current environmental issues in the context of community-based learning. Topics for investigation are selected by faculty, usually in conjunction with the campus sustainability coordinator, the Upstate Institute, or directly with local and regional agencies or organizations. Students get practical experience working in interdisciplinary teams to examine environmental issues with a goal of developing relevant recommendations.

A few of the many student research projects stemming from these courses include:

- Willow Biomass: an assessment of the ecological and economic feasibility of growing willow biomass for Colgate University
- A feasibility report of creating and managing a student-led community vegetable garden on campus
- An evaluation of and proposal to improve Colgate's electronic waste recycling program
- An analysis of geothermal applications at Colgate
- An evaluation of the energy efficiency of Colgate buildings using the EPA Portfolio Manager
- A critique of institutional climate action plans and recommendations for Colgate's plan
- Commuting behaviors of Colgate employees and recommendations for implementing a carpooling program

- Identifying the benefits and barriers of fostering sustainable behavior on campus
- Researching the barriers and opportunities of increasing local food options in our campus dining halls
- Evaluating the voluntary carbon offset market for application at Colgate
- Paper purchasing and consumption at Colgate University: An analysis of current paper use and recommendations for the future
- Investigation of the feasibility of incorporating hybrid and electric vehicles into the Colgate vehicle fleet
- Colgate University's heating system: examining the sustainability of woody biomass
- Exploring the economic, environmental, and social implications of trayless dining at Colgate University

These student research projects are a sample of recent academic research done in collaboration with the Sustainability Office with a focus on campus operations and institutional planning. These opportunities are engaging to students and valuable to their educational experience. At the same time, this research provides important data and analyses that ultimately help to advance the practice of sustainability at Colgate.

Recommended Action:
One mechanism to further promote sustainability in the curriculum is through the annual faculty retreat held at the White Eagle Conference Center. In Spring 2011, the first sustainability in the curriculum seminar was held at White Eagle. During this discussion, faculty shared best practices about how they incorporate sustainability into their programs and explored the meaning of sustainability as it relates to their area of expertise. In the years ahead, the Sustainability Office will continue to work with faculty and the faculty retreat organizers to enhance and expand the sustainability session at White Eagle.

5.2 CO-CURRICULAR EDUCATION

Center for Leadership and Student Involvement (CLSI)

The Center for Leadership and Student Involvement (CLSI) supports, challenges, and inspires Colgate students to become responsible and engaged citizens. CLSI staff encourage students to find meaningful co-curricular opportunities and they help students build their leadership skills in the areas of communication, budget management, delegating, and managing logistical aspects of events.

CLSI is the hub for the student-run organizations on campus that are recognized by the Student Government Association (SGA). Currently, there are 10 student organizations representing about 100 students that actively promote sustainability on campus. Student clubs such as the Students for Environmental Action, Green Thumbs, the Compost Club, and Green Bikes serve as peer educators who foster the principles of sustainability into day-to-day learning and living at Colgate.

Students also organize annual events such as the Green Summit, 13 Days of Green, Eco-Olympics, and RecycleMania. Each of these events instills the values of sustainability into Colgate's culture while providing students the opportunity to develop their organizational and leadership skills.

Thought into Action Institute (TIA)

One exciting new initiative that is supported by CLSI is the Thought into Action Institute (TIA). Thought into Action is a non-credit practical entrepreneur course. The new institute is led by Alumnus Andy Greenfield '74 who—along with other institute instructors—offers tools, techniques, and support to turn a student idea or project into reality.

Recent student projects include developing a system to compost organic waste from Colgate's dining halls, developing the half-acre student vegetable garden, and launching a business that will sell environmentally friendly office and school supplies.

Sustainability Office Internships

Throughout the year, Colgate's Sustainability Office hires student interns. These internships offer a great way for students to become introduced to campus sustainability and the sustainability movement in general. Through collaboration with Colgate's sustainability coordinator, students develop measurable and obtainable goals that they work on throughout their internship. Student interns have successfully completed a cost-benefit analysis of implementing a composting program at Colgate, completed Colgate's first comprehensive greenhouse gas inventory, developed Colgate's Green Living Program, managed and led the startup of Colgate's vegetable garden, enhanced and expanded the Green Bikes Program, implemented a campus-wide electronic waste recycling program, created a student sustainability radio show on WRCU, and evaluated and made recommendations for improving Colgate's recycling infrastructure.

Moreover, sustainability interns learn professional skills such as meeting facilitation, strategic planning, establishing meeting agendas, critical analysis, writing proposals, interdisciplinary collaboration, and other important professional skills.

5.3 SERVICE LEARNING AND VOLUNTEERISM

UPSTATE INSTITUTE

Colgate University's Upstate Institute creates links between the university and the regional community to engage students, faculty, staff, and residents in research and a reciprocal transfer of knowledge that will enhance the economic, environmental, social, and cultural capacity of the region. Upstate Institute-supported projects provide a model of community collaboration and civic engagement for our students and within higher education.

The Upstate Institutes' Field School matches students with regional community, government, or non-profit organizations to develop and implement projects that bolster organizational capacity. Field School fellows work with a community partner to create and complete projects that help advance sustainability in the Upstate region. The Institute also supports engagement in the community within the framework of an academic course in a variety of ways. This community-based research allows students to complete independent work on innovative projects that provide a community benefit. Through place-based learning, students develop a deeper understanding of the issues facing the Upstate region and a strong appreciation for what the region has to offer.

In the summer of 2010, 19 Colgate students worked with community, not-for-profit, and government organizations as part of the Upstate Institute Field School. A few examples of Field School students and their work includes:

- **Molly Kunzman '12**, worked with the Agricultural Economic Development Program to plan, implement, and evaluate the third annual Buy Local week. This event highlighted the benefits to the economy, environment, and agricultural community of buying locally. The week included three events: a Local Foods showcase, a Fresh! Gala, and an Open Farm Day. Kunzman promoted the event throughout the county with postcards, fliers, and press releases, recruiting volunteers, working with restaurants, and assisting during the event. After the week, she created a follow-up survey for participating farms and restaurants.
- **Michael Palmer '10** and **Katy Morley '10** completed rapid market assessments of the four farmers' markets of Madison County: Lenox, Cazenovia, Hamilton, and Oneida. Their research demonstrated the importance of farmers' markets to the local economy. Palmer's preliminary estimates of market sales indicated that the Hamilton market sees over $20,000 of sales per day. A county-wide estimate for the entire season is near one million dollars.
- **Zach Roman '12** worked on a project that will ultimately result in a series of different trails connecting Utica and Binghamton, allowing people to walk or bike the 97-mile distance between the two cities.
- **Kelly Boyle '10** worked with For the Good, an organization in Utica that runs the Urban Garden Initiative, a community-driven project that provides inner-city residents with fresh fruits and vegetables in exchange for work done in the gardens. The city of Utica has supported the initiative by providing two additional sites for the initiative, which will allow for the creation of over 100 additional raised beds.

- **Nicole Dennis '11** completed a qualitative research study sponsored by Shapna Tea & Coffee Company and the Upstate Institute. Shapna reinvests 40% of its net profits into sustainable community development initiatives. Twenty percent is reinvested in the farming communities where Shapna products are grown in Bangladesh and Uganda and 20% is reinvested where the products are purchased. Because the Barge Canal Coffee Co. in Hamilton serves Shapna Tea & Coffee, 20% of net sales will be reinvested into Hamilton and the greater community.

Additionally, the institute values scholarly collaboration as a way to support the region. The Upstate Institute serves to promote faculty scholarship on, or directly pertaining to, the upstate region of New York by providing support for both the costs of research as well as a stipend award for the Colgate faculty investigator. Recent faculty research awards include:

- **Charles "Pete" Banner-Haley,** professor of history and Africana & Latin American studies, is conducting research on the history of African Americans in the Upstate counties of Broome, Chemung, and Steuben to consider gender relations between African American men and women between 1890 and 1950. Once completed, this research will contribute to an understanding of African American experiences in these counties, which is an important, and often overlooked, part of New York State history.
- **Beth Parks,** associate professor of physics, is conducting research on the development of a new device that will allow homeowners to learn the insulation levels in their homes and start the process of increasing the energy efficiency of their homes. For homeowners in a severe climate such as Upstate New York who spend over $1,000 annually on heating, the product can prove beneficial. With this grant, Parks can test the device in single-family homes in the village of Hamilton.
- **Daisaku Yamamoto,** assistant professor of geography and Asian studies, conducted research on rural prosperity and resilience in the Upstate New York region. Rural prosperity is an alternate way of measuring a community's success by considering employment rates, levels of poverty, school enrollment, and housing conditions, in addition to patterns of economic growth.

Service learning that incorporates the theory and practice of sustainability also takes place through the formal curriculum. A few recent examples include:

FSEM 130: Energy and Sustainability, Professor Beth Parks
Course description: This first-year seminar studied energy use with the goal of understanding the challenges and possibilities of sustainable practices. In addition to readings and problem sets, students participated in projects related to the course content. They examined the energy use of a first-year residence hall on campus, and worked with residents and with Buildings and Grounds to decrease energy use. They also participated in a Habitat for Humanity build run by the Oneida County chapter, which is trying to gain ENERGY STAR and LEED certifications for their newly constructed homes.

GEOG 401: Senior Seminar, Professor Jessica Graybill
Course description: The students in this course worked in groups to better understand cultural transformation, socio-spatial transformation, and green space transformation of Utica, N.Y. Students were involved in data collection, analysis, and writing and presenting of a research paper. The first two groups working with the Mohawk Valley Resource Center for Refugees were able to conduct interviews of Bosnian refugees to gain an understanding about their sense of place and create a spatial distribution map of residence of different refugee groups within the city of Utica. This research has been shared with the Refugee Center. The third group worked to document the history of green spaces in Utica.

THE CENTER FOR OUTREACH, VOLUNTEERISM, AND EDUCATION (THE COVE)
The Center for Outreach, Volunteerism, and Education (the COVE) is Colgate's center for service, citizenship, and community building. The COVE supports volunteer organizations, service learning classes, internship programs, residential life initiatives, and social change-oriented career counseling. COVE-sponsored student groups that work to promote sustainability in our region include:

Colgate Hunger Outreach Program (CHOP)
CHOP targets issues of hunger in Madison County and strives to educate the Colgate community about the deeper issues surrounding hunger and poverty. Group members participate directly in one or more of the following ways: working in the Friendship Inn Soup Kitchen on Monday nights, volunteering at the Hamilton Food Cupboard on Tuesdays or Thursdays, or salvaging food from various locations on campus to deliver to the soup kitchen. The group also hosts fundraising events throughout the semester.

Habitat for Humanity
Habitat for Humanity is an international non-profit organization dedicated to providing affordable, decent housing to families in need. Colgate Habitat helped complete a home last May and while funds are raised for a subsequent build, Colgate Habitat will focus on landscaping assistance, trail maintenance, general construction repairs, and fundraising. Overall, Habitat champions hard work and cooperation to improve lives and living conditions throughout the Hamilton area.

The Green Earth Gang (GEG)
The Green Earth Gang (GEG) mission is to promote environmental awareness among children ages 8 – 10 in local schools through experiential and interactive activities. Once every two weeks, the GEG student members teach a 40-minute class about an environment-related topic. The GEG works with elementary students and their teachers in hopes that the students will apply what they learn to their daily lives.

Literacy for Refugees
The mission of the group is to provide general learning assistance to teenage refugees studying at Proctor High School in Utica, N.Y. Many refugees rank at the bottom of the socioeconomic spectrum and are marginalized by society. In the educational environment, refugees are put into age appropriate classes without knowing any English. Literacy for Refugees aims to alleviate this inequity by tutoring refugees in English for three hours a week, on a designated afternoon.

The Hamilton Outdoor Group (HOG)
The mission of the Hamilton Outdoor Group is to teach local Hamilton middle-schoolers outdoor skills and an environmental ethic that will encourage them to experience the outdoors in a positive manner. HOG volunteers and Hamilton students meet at the Outdoor Education Base Camp and spend about 90 minutes outside, usually on the ski hill. Activities include scavenger hunts, rock climbing, snowshoeing, and capture the flag.

6.0 TRACKING PROGRESS AND FUTURE DATA COLLECTION
SUSTAINABILITY AND CLIMATE ACTION PLAN

Continuous monitoring and tracking of our progress is an essential component of Colgate's sustainability program and climate action planning goals. For each sustainability initiative and mitigation strategy identified in this report, we have highlighted our milestones, metrics and timelines, and those who will take the lead responsibility in pursuit of those targets. As a result, monitoring and evaluating our progress was not an afterthought but built directly into each strategy. In addition, Colgate will continuously track our progress through:

- The publication of our annual Greenhouse Gas Inventory
- Publication of the Sustainability Office's Annual Sustainability Review
- Updating our Sustainability and Climate Action Plan on a routine basis in compliance with the ACUPCC reporting guidelines
- Tracking our sustainability "Dashboard Indicators" that offer a snapshot of our progress over time. Colgate's Dashboard Indicators include:
  - Colgate's annual Greenhouse Gas Emissions Inventory in MTeCO2
  - Total electricity consumption in kWh
  - Fuel oil #6 consumption in gallons
  - Fuel oil #2 consumption in gallons
  - Wood chips consumed in tons
  - Landfill waste generated in short tons
  - Colgate's annual recycling rate
  - Paper consumption in pounds of paper purchased for each type of paper stock (e.g., 30% recycled, 50% recycled, 100% recycled, etc.)
  - Local food purchased measured as a percentage of money spent on food produced within a 150-mile radius

While it is important and worthy for Colgate to establish our own metrics for measuring sustainability, there is also merit in joining and participating in a nationally recognized system that provides meaningful metrics and comparisons across institutions over time. For this reason, we recommend that Colgate join AASHE's Sustainability Tracking, Assessment & Rating System (STARS).[36] STARS has emerged as the most comprehensive sustainability framework in higher education.

[36] https://stars.aashe.org/

7.0 CONCLUSION
SUSTAINABILITY AND CLIMATE ACTION PLAN

Colgate has a long history of supporting campus sustainability. From the installation of our wood-fired boiler in 1981 to the publication of this Sustainability and Climate Action Plan in 2011, Colgate has demonstrated over 30 years of commitment to combating climate change and advancing sustainability. As a signatory to the American College and University President's Climate Commitment and as a recognized leader in sustainability in higher education, Colgate is committed to climate neutrality by 2019. However, achieving climate neutrality is more of a milestone than an end goal. Along the way, we will remain focused and dedicated to reducing Colgate's gross emissions as much as practicably possible. To start, we have established a target of reducing emissions by 35% from 2009 levels by 2015 and 40% from 2009 levels by 2020. This trajectory would bring our gross emissions to just over 10,600 MTeCO2 in 2019, putting us in a position to utilize offsets to achieve climate neutrality in 2019.

With our innovative long-term agreement to purchase forestry-based carbon offsets through Patagonia Sur in 2011, our remaining carbon balance in 2019 is expected to be a little over 5,000 MTeCO2. From now until our climate neutrality date of 2019, we will continue to explore high-quality offset options that will advance our academic mission.

Not only will the strategies identified in this plan help Colgate meet some of our core institutional challenges (e.g., employee and student recruiting, institutional resiliency, enhancing alumni relations, elevating campus spirit, and bolstering our liberal arts education), but the plan is also fiscally responsible as we expect to reduce our annual operating budget by over $750,000.

Colgate's Sustainability and Climate Action Plan had widespread participation and approval from many campus stakeholders. The plan is a mosaic of thought-leadership, research, and opinions from the campus community on the best approach to achieve climate neutrality. Students and faculty contributed valuable research and administrators provided key insights and direction. The seven Climate Action Plan Subcommittees proposed mitigation strategies while the Sustainability Council, the Climate Action Plan Steering Committee, and the president's staff reviewed the plan and offered comments and feedback. We are proud of the collaborative approach taken to complete this long-term strategic plan.

At the same time, the plan spans many years and it must remain a living document—open to new ideas, technologies, and opportunities. Along our journey to campus sustainability and climate neutrality, we anticipate roadblocks, detours, and unexpected shortcuts. As a result, the Sustainability and Climate Action Plan will be reviewed on a continual basis and updates will be made as needed. With widespread support and feedback from a diverse group of campus stakeholders, we are ready.