Barnard College
2016 Carbon Footprint Report

Fiscal Year 2015 (July 2014 – June 2015)

Prepared by

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Graphic designed by Sandra Goldmark, images from barnard.edu

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Objective: Gotham 360 was enlisted to compile institutional data necessary to conduct an analysis of Barnard College's Greenhouse Gas Emissions for the 2015 fiscal year (July 1, 2014 – June 30, 2015). Results will be used by the Sustainability Working Group of the Divestment Task Force.

Executive Summary: Following the Greenhouse Gas Protocol guidelines, emissions in Scope 1, 2, and 3 were assessed. Data was collected from several departments, and assumptions were applied to the data to fill in the gaps as necessary. The results of the analysis show that Scope 3 emissions contribute the most to Barnard's overall Carbon Footprint. Within Scope 3, the largest contributors were student travel to/from home, food (dining hall and catering), and solid waste. While the distance students must travel between campus and their homes is unlikely to change, especially as Barnard recruits more and more international students, it is possible to enact changes on campus to reduce the impacts of food purchasing and waste sent to landfills. For example, collecting trash and recycling tonnage data will make it easier to set waste reduction and diversion goals and monitor progress towards them. Loose policies can also be made that will reduce the impacts of catering, such as reducing the number of meetings held during lunch hours, or using reusable catering products.

Outside of Scope 3, the two next-highest contributors were on-campus stationary combustion (in Scope 1) and purchased electricity (in Scope 2). These two categories are large contributors at all institutions, because operating a campus is very energy intensive. Barnard has already been making great strides in increasing the efficiency of the campus energy systems, thereby reducing emissions in these categories, but there are always opportunities to do more. Behavioral changes especially are a necessary step towards energy and carbon reductions.

Overall, Barnard's emissions for fiscal year 2015 amounted to 22,144.6 metric tonnes of carbon dioxide equivalent (MT eCO_2), which is roughly the same as the annual emissions of 4,712 cars[1]. Compared to the GHG reports of 7 selected colleges and universities, Barnard was slightly above average for MT eCO_2 per full-time enrollment, and farther above average for MT eCO_2 per 1,000 square feet. However, great significance should not be placed on these comparisons due to the different data collection methods and accounting techniques employed by each school. This is particularly true in the case of Scope 3 emissions, since there is no standardization for what subcategories must be reported on.

The results of the report indicate that Barnard is already taking steps to reduce their carbon footprint, but that there is opportunity to take further action on many levels. Continued reporting and communication of these results will raise awareness on campus – the first step in creating change within our campus community and operations. Few other campuses have reported their emissions with this kind of 360-degree analysis; this step can serve as a springboard for a climate action plan that sets an equally comprehensive and unique standard.

[1] https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0

Introduction

Universities have long been a leader in environmental and sustainability initiatives. From fossil fuel divestment campaigns, to hands-on research, to pushing for net-zero campuses, students' interests have been driving administration to comply. As part of this, greenhouse gas emissions reporting has gained popularity. Setting the standards for this reporting is the Greenhouse Gas (GHG) Protocol.

Developed by the World Resource Institute (WRI) and the World Business Council on Sustainable Development (WBCSD) over a decade-long partnership, the GHG Protocol was published in 2001, and now serves as the basis for nearly every GHG standard in the world. These standards provide a common, credible accounting method to measure, track, and report GHG emissions, the driving force of climate change.

Following these standards, the non-profit organization Clean Air-Cool Planet, together with The University of New Hampshire's Sustainability Institute (UNHSI), created the Campus Carbon Calculator (CCC) in 2001. Since 2014, management of the CCC and its online successor, CarbonMAP, has been taken over fully by UNHSI.[2] Following its creation, the CCC quickly became the primary tool for other institutions undertaking campus-wide GHG inventories and is recognized by external programs as a high-quality reporting tool. It is for this reason that we chose this calculator to analyze the majority of the data collected for the study. The Campus Carbon Calculator tracks the six internationally-recognized greenhouse gasses (CO2 CH4, N2O, HFC and PFC, and SF6) and includes emissions from Scope 1, 2, and 3.

- **Scope 1** - direct emissions from owned or controlled sources, such as onsite fuel combustion for heating & cooling or from campus fleet vehicles
- **Scope 2** - indirect emissions from the generation of purchased electricity
- **Scope 3** - all other indirect emissions, such as those released in daily commutes to and from campus, school-sponsored travel, trash disposal, the production of office paper and other purchased goods, and more

The Calculator can also track offsets, which are measures taken to counter the negative effects of GHG emissions. These offsets include on-campus composting, protecting forest land from development, and the purchase of Renewable Energy Certificates (RECs) - tradable commodities that represent the creation of 1 megawatt-hour (MWh) of renewable energy. Barnard College is currently not involved in any carbon off-setting initiatives.

Wanting to conduct an all-encompassing report that included emissions from all the "Stuff"[3] purchased by the college, Barnard was not satisfied with the Scope 3 categories covered in the CCC,

[2] http://campuscarbon.com/About.aspx

[3] The concept of "Stuff" is borrowed from The Story of Stuff, a project that tackles the environmental and social issues related to our "consumption-crazed culture". http://storyofstuff.org/about/

so an additional calculator was employed to provide carbon coefficients for other categories in Scope 3, such as food, furniture, electronics, and more. The calculator selected was Carbon Footprint Ltd.'s online carbon calculator.[4] Although geared towards households, the calculator offered geography-specific coefficients that worked with the available data inputs. Since a campus is almost like a giant household, we found the calculator to be suitable.

Institutional Data: Data was provided by the Office of Facilities and Operations.

Operating Budget	$150,290,506.59
Research Budget	$2,147,007.24
Energy Budget	$1,263,858.60
# Full Time Students	2,539
# Summer School Students	290
# Faculty	349
# Staff	1,019
Total Building Space (sqft)	1,177,000
Total Research Bldg Space (sqft)	50,000

[4] http://calculator.carbonfootprint.com/calculator.aspx

Scope 1 Emissions

On-Campus Stationary Combustion

Sources of emissions from stationary combustion include boilers, heaters, furnaces, kilns, ovens, flares, thermal oxidizers, dryers, and any other equipment or machinery that combusts carbon bearing fuels or waste stream materials.[5] Between the purchase of fuel oil and natural gas, Barnard consumed 82,380.0 million British thermal units (MMbtus), resulting in the emission of 4,594.6 metric tonnes of CO_2 equivalent (MT eCO_2).

Data Source: The total amount of fuel oil and natural gas consumed was pulled from the Greenhouse Gas Inventory submitted as part of participation in the NYC Carbon Challenge. That data is a summary of all utility bills for the given time period for each utility account.

Approach: The CCC takes the usage information and multiplies it by the appropriate carbon coefficient for each fuel type.

Direct Transportation

Direct transportation refers to the fuel consumed by Barnard's fleet vehicles. Barnard's fleet is very small, consisting of two Public Safety vehicles and one Facilities vehicle. In Fiscal Year 2015, 3,264 gallons of fuel were purchased for these vehicles, resulting in the emission of 29.7 MT eCO_2

Data Source: Amounts of fuel purchased were provided by the Office of Campus Services Administration.

Approach: The CCC takes the usage information and multiplies it by the appropriate carbon coefficient for each fuel type.

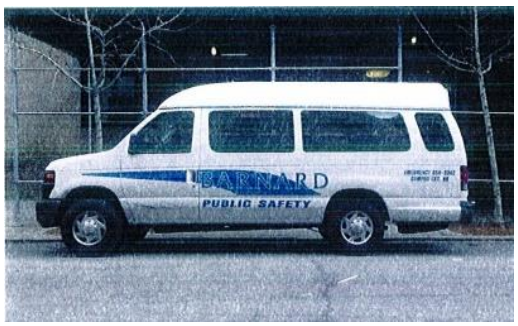


Image source: barnard.edu/publicsafety

[5] (U.S. EPA Center for Corporate Climate Leadership, 2016)

Scope 2 Emissions

Purchased Electricity

Purchased electricity is typically used for lighting, plug loads, and HVAC systems. Barnard consumed 30,136.9 MMbtus, resulting in the emission of 2,529.3 MT eCO_2.

Data Source: The total amount of electricity consumed was pulled from the Greenhouse Gas Inventory submitted as part of participation in the NYC Carbon Challenge. That data is a summary of all utility bills for the given time period for each utility account.

Approach: The carbon calculator we employed takes the usage information and multiplies it by the appropriate carbon coefficient for each fuel type. Since Scope 2 emissions are not released on-site, the carbon coefficients used differ depending on the geographic location of the site. The Emissions & Generation Resource Integrated Database (eGRID) has developed different regions across the country, each with their own set of emissions factors, depending on the type of power plants in that region. Barnard falls within the New York City/Westchester eGRID region. Since the NYC Carbon Challenge does not use eGRID, instead opting for more NYC-specific coefficients, the emissions calculated in this report will not match Barnard's NYC Carbon Challenge GHG Inventory. The NYC Carbon Challenge also reports by calendar year, rather than fiscal year.

Liz's Café – The Diana Center
Image source: barnard.edu

Scope 3 Emissions

Staff & Faculty Commuting

Staff and faculty commuting resulted in the emission of 670.0 MT eCO_2.

Data Source: A list of home zip codes for staff and faculty was provided by Human Resources.

Data Constraints: Due to reporting and database constraints, we were only able to collect information for current faculty and staff, as opposed to data representative of the 2014-2015 year. However, we assumed that the make-up of the staff and faculty would not have changed significantly enough between then and now to have any meaningful impact on this study.

Approach: Using Google Maps, the distance between Barnard and each zip code was calculated in driving miles. Mileage was then summed based on categories, as defined by the assumptions, and entered into the CCC.

Assumptions Made: Total trips to and from campus were calculated on a per person basis using the below assumptions.

	Weeks	Avg. Days/Week	Trips/Day	Total Trips Per Person
Staff Year	48	5	2	480
Faculty Academic Year	28	3.25	2	182
Student Academic Year	28	3.25	2	182

Assumptions also had to be made about what the primary mode of transportation would be for each individual. They are as follows:

Walk/Bike – Individuals living in the same zip code as Barnard, 10027.
Bus – Individuals living 1-2 miles away, excluding those in the 10027 zip code; individuals living in the NJ bus corridor.
Commuter Rail – Individuals living within the 5 boroughs of New York City, excluding areas not accessible by subway; individuals living along the access route of the Long Island Railroad, New Jersey Transit, PATH, Amtrak, or Metro North Trains; individuals living in Philadelphia.
Car – Individuals living 50+ miles away.
Plane – Individuals living 400+ miles away.

	Mode	Mileage Range	Assumption Factor	Trips Per Person	Total Miles	Individuals Count
Staff	Walk/Bike	1	1.00	480.00	11,520.00	24
Staff	Bus	1-2	1.00	480.00	34,080.00	54
Staff	Commuter Rail	1-49	1.00	480.00	2,190,528.00	462
Staff	Commuter Rail	50-99	0.75	360.00	534,240.00	21
Staff	Commuter Rail	100+	0.50	240.00	109,920.00	4
Staff	Car	50-99	0.50	240.00	23,280.00	1
Staff	Car	99-199	0.25	120.00	56,760.00	4
Staff	Car	200-399	0.125	60.00	65,940.00	4
Staff	Plane	400+	0.03125	15.00	420,150.00	1
			TOTALS	268,830.00	4,166,418.00	575

	Mode	Mileage Range	Assumption Factor	Trips Per Person	Total Miles	Individuals Count
Faculty	Walk/Bike	1	1.00	182.00	12,740.00	70
Faculty	Bus	1-2	1.00	182.00	28,756.00	145
Faculty	Commuter Rail	Any	1.00	182.00	1,090,908.00	376
Faculty	Car	50-149	0.50	91.00	77,987.00	9
Faculty	Car	150-399	0.25	45.50	83,993.00	7
Faculty	Plane	400-999	0.125	22.75	32,418.75	2
Faculty	Plane	1000-3499	0.0625	11.375	191,293.38	7
Faculty	Plane	3500+	0.03125	5.6875	40,950.00	2
			TOTALS	108,836.00	1,559,046.13	618

Student Commuting

Student commuting resulted in the emission of 243.7 MT eCO_2.

Data Source: A list of home zip codes for all registered commuting students was provided by the Registrar's Office.

Data Constraints: Due to reporting and database constraints, we were only able to collect information for current students, as opposed to data representative of the 2014-2015 year. While the student body changes more than staff and faculty, we still do not feel that the nature of the changes are significant for the purpose of this initial study.

Approach: Using Google Maps, the distance between Barnard and each zip code was calculated in driving miles. Mileage was then summed based on categories, as defined by the assumptions, and entered into the CCC.

Assumptions Made: For all students living in campus housing, it was assumed that they are using carbon-free modes of transportation to get to and from campus, such as biking or walking. For commuters, assumptions had to be made about what the primary mode of transportation would be for each individual. They are as follows:

Walk/Bike – Individuals living in the same zip code as Barnard, 10027.
Bus – Individuals living 1-2 miles away, excluding those in the 10027 zip code; individuals living in the NJ bus corridor.
Commuter Rail – Individuals living within the 5 boroughs of New York City, excluding areas not accessible by subway; individuals living along the access route of the Long Island Railroad, New Jersey Transit, PATH, Amtrak, or Metro North Trains; individuals living in Philadelphia.
Car – Individuals living 50+ miles away, or outside of public transit routes.
Plane – Individuals living 400+ miles away.

	Mode	Mileage Range	Assumption Factor	Trips Per Person	Total Miles	Individuals Count
Students	Walk/Bike	1	1.00	182.00	2,002.00	11
Students	Bus	Any	1.00	182.00	26,390.00	44
Students	Commuter Rail	Any	1.00	182.00	357,630.00	112
Students	Car	1-49	1.00	182.00	41,314.00	7
Students	Car	50-149	0.50	91.00	85,176.00	9
Students	Car	150-399	0.25	45.50	369,505.50	35
Students	Plane	400+	0.03125	5.6875	756,124.69	72
			TOTALS	34,489.00	1,638,142.19	290

Directly Financed Travel - Domestic

Domestic travel resulted in the emission of 822.9 MT eCO_2.

Data Source: Data for this section was received from the Purchasing Department in the form of excel sheets that were generated from their expense processing program. The only data readily available were the travel expenses charged to the Barnard Master Card (MC) and American Express (AMEX) accounts.

Data Constraints: Line items in the excel sheets included coffee and food purchased while travelling, hotel bookings, cab fare, airfare, baggage fees, road tolls, and more, making it difficult to parse out the relevant lines. Additionally, it was not always clear to where the individuals were travelling based on the given description. For example, descriptions could be as vague as "symposium travel". Even if the vendor for this charge is Jetblue, signifying that it represents a trip taken, there would not be enough additional relevant information to include this trip in our inventory.

Approach: The first step was to determine which line items qualified as trips. Next, we determined the extent of the trip, the mode of transportation, and the total mileage of the trip. Some descriptions clearly defined the trip, while others prompted additional research. Many descriptions named particular conferences or symposium, whose locations could be determined by a quick online search. Vendor information was used to determine the mode of transportation (eg. Amtrak = train; Jetblue = airplane). Then, Google Maps was used to determine the total mileage of the trip, and mileage was summed based on categories, as defined by the assumptions, and entered into the CCC.

Assumptions Made: To account for the gaps in the data, Assumption Factors (AFs) were assigned to each mileage subtotal for each mode of transportation. Finance advised that the travel charged to the Master Card and the American Express accounts represents approximately 50% of domestic travel, so all modes initially received an AF of 2. Then, considering the line items for trips that did not provide enough information, we increased the AF, based on the number of observed occurrences of vague data.

Account	Mode	Miles	Assumption Factor	Subtotal
MC	Bus	1,360.00	2.00	2,720.00
MC	Car	5,550.00	5.00	27,750.00
MC	Plane	620,364.00	2.00	1,240,728.00
MC	Train	37,334.00	2.00	74,668.00
AMEX	Bus	0.00	2.00	0.00
AMEX	Car	150.00	5.00	750.00
AMEX	Plane	102,957.00	3.00	308,871.00
AMEX	Train	1,180.00	2.00	2,360.00
			TOTAL	1,657,847.00
			MT eCO_2	822.90

Directly Financed Travel - International

International travel resulted in the emission of 859.0 MT eCO_2.

Data Source: Data for this section was received from the Purchasing Department in the form of excel sheets that were generated from their expense processing program. The data included travel expenses charged to the Master Card (MC) and the American Express (AMEX) accounts and payments made directly to international vendors (Direct).

Data Constraints: See "Directly Financed Travel – Domestic".

Approach: See "Directly Financed Travel – Domestic".

Assumptions Made: To account for the gaps in the data, Assumption Factors (AFs) were assigned to each mileage subtotal for each mode of transportation. Considering the line items for trips that did not provide enough information, we increased the AF, based on the number of observed occurrences of vague data.

Account	Mode	Miles	Assumption Factor	Subtotal
MC	Bus	156.00	2.00	312.00
MC	Car	550.00	4.00	1,650.00
MC	Plane	318,133.00	1.25	397,666.25
MC	Train	538.00	2.00	1,076.00
AMEX	Bus	0.00	1.00	0.00
AMEX	Car	401.00	4.00	1,203.00
AMEX	Plane	181,862.00	1.00	181,862.00
AMEX	Train	0.00	1.00	0.00
Direct	Car	60.00	1.00	60.00
Direct	Plane	1,198,354.00	1.00	1,198,354.00
			TOTAL	1,782,183.25
			MT eCO_2	859.00

Study Abroad Travel

Study abroad travel resulted in the emission of 872.3 MT eCO_2.

Data Source: A list of students who studied abroad during FY 2015 and their study abroad program was provided by Finance.

Approach: Using Google Maps, the distance between Barnard and each city (or cities for some programs) was calculated. The total mileage was then entered into the CCC.

Reid Hall courtyard – Columbia-Penn program in Paris, France
Image source: columbiaprograms.fr

Student Travel to/from Home

Student travel to/from home resulted in the emission of 4,568.3 MT eCO_2.

Data Source: A list of home zip codes for current students was provided by The Office of Admissions. Residence Life & Housing also provided lists of students who stayed on campus during the August 2014 interim, winter break, and the May 2015 interim.

Approach: Using Google Maps, the distance between Barnard and each home zip code was calculated and summed based on the categories laid out by the assumptions. The total mileage was then entered into the CCC.

Assumptions Made: The base case for this list was that each student made 4 trips between home and Barnard, one for the beginning and end of each semester. Two trips were deducted from those who stayed during winter break, and one trip was deducted from those who stayed in either interim period.

It was also assumed that anyone living within 400 miles of campus travelled by car with all their belongings, despite the availability of other modes of transportation. Those living greater than 400 miles away were assumed to travel by airplane.

Lastly, an Assumption Factor was applied to the airplane mileage based on the assumption that students who live a considerable distance from campus do not always travel home, even if they are not staying on campus.

Mode	Mileage Range	Miles	Assumption Factor	Total Miles	Individuals Count
Car	1-399	450,615.63	1.00	450,615.63	1,451
Plane	400+	12,392,594.41	0.75	9,294,445.81	1,099
			TOTALS	9,745,061.44	2,550

Solid Waste

Solid waste resulted in the emission of 1,962.2 MT eCO_2.

Data Source: A waste management report was provided by Action Carting Environmental Services, Barnard's municipal solid waste and non-hazardous recyclables. This report included total diverted tonnage and landfilled, residual trash tonnage. A tonnage report for hazardous waste material pick-up was provided by Veolia, Barnard's hazardous waste storage and transfer vendor. The information provided included details regarding management of the waste.

Data Constraints: Action Carting does not weigh each pick-up from Barnard, so all data in the report was based on estimates provided by Action Carting.

Approach: Total tonnage of landfilled waste was taken from the report provided by Action Carting. For hazardous waste, tonnage of all hazardous materials destined for incineration was summed. The totals were then entered into the CCC.

Food – Catering, Dining, & More

Production of the food purchased resulted in the emission of 3,101.27 MT eCO_2.

Data Source: Catering and Dining Hall budget figures were provided by the Office of Facilities and Operations. Other food purchasing figures were extracted from a list of supplies expenses provided by the Director of Budget and Planning.

Data Constraints: The initial catering budget provided was inclusive of food and supplies, but dining was split into food and food "stuff". To remove food "stuff" from the catering total, we applied the same ratio as the dining hall budgets. Food "stuff" is accounted for in Purchased "Stuff", below.

Approach: Carbon Footprint Ltd.'s online carbon calculator[6] was used to convert dollars spent to emissions equivalents.

	Cost/Budget	MT eCO_2
Catering Food	$1,342,759.00	1,294.90
Dining Hall Food	$1,849,779.00	1,783.85
Other Food	$23,351.00	22.52
TOTALS	$3,215,889.00	3,101.27

Millicent Carey McIntosh Student Dining Room – The Diana Center
Image source: barnard.edu

[6] http://calculator.carbonfootprint.com/calculator.aspx

Purchased "Stuff" – Paper, Furniture, Electronics, & More

Production of "stuff" purchased resulted in the emission of 1,734.94 MT eCO_2.

Data Source: Number of reams of standard copy paper was provided by Finance. Budget figures for furniture, electronics, and non-food dining hall & catering products were provided by the Office of Facilities and Operations. Other "Stuff" purchasing figures were extracted from a list of supplies expenses provided by the Director of Budget and Planning.

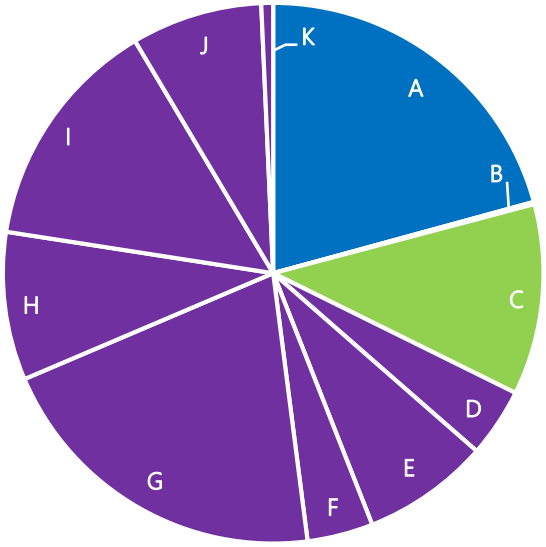
Data Constraints: Where possible, line items from the list of supplies expenses (Other "Stuff") were grouped into the following categories: Pharmaceuticals, Fabrics & Clothing, Electronics, Books & Paper, Furniture & Other Manufactured Goods, Cultural Activities. However, a majority of the line items did not contain enough detail to be grouped, so were defaulted to the Furniture & Other Manufactured Goods category.

Approach: The total number of reams of copy paper was converted to pounds and entered into the CCC. For all other budget figures, Carbon Footprint Ltd.'s online carbon calculator was used to convert dollars spent to emissions equivalents.

	Cost/Budget	MT eCO_2
Copy Paper		84.30
Paper	$64,303.00	38.77
Furniture	$831,000.00	383.58
Electronics	$475,000.00	283.42
Other "Stuff"	$2,061,935.00	944.87
TOTALS	$3,432,238.00	1,734.94

Results

Fiscal Year 2015			eCO_2 Metric Tonnes	Percent of Total
Scope 1	A	Stationary Combustion	4,594.6	21%
	B	Fleet Vehicles	29.7	<1%
Scope 2	C	Purchased Electricity	2,529.3	11%
Scope 3	D	Commuting	913.7	4%
	E	Directly-financed Travel	1,681.9	8%
	F	Study Abroad Air Travel	872.3	4%
	G	Student Travel to/from Home	4,568.3	21%
	H	Solid Waste	1,962.2	9%
	I	Food	3,101.3	14%
	J	Stuff	1,734.9	8%
	K	Scope 2 Line Losses	156.3	1%
Totals		Scope 1	4,624.3	21%
		Scope 2	2,529.3	11%
		Scope 3	14,990.9	68%
		All Scopes	22,144.6	



The majority of Barnard's greenhouse gas emissions fall under the Scope 3 category. The largest contributor to this, at 21% of total emissions, is student travel to/from home, due to the large number of international students and students from across the United States. Next in Scope 3 is consumption of food and goods (stuff), totaling 22%. Solid waste, which is closely related to food and goods purchased, was also a large contributor to Scope 3 at 8%. Data reported from the waste vendor, Action Carting, estimated that only 11.5% of all waste collected during the study period was recycled and diverted, meaning that a vast majority of the waste is sent to landfills.

Aside from student travel to/from home and food, Scope 1, on-campus stationary combustion and Scope 2, purchased electricity contribute more than any individual Scope 3 sub-category. Commuting is likely a much smaller contributor at Barnard than other institutions thanks to the urban setting of the campus and the extensive public transportation network.

The results of the study were compared to GHG Inventories of schools that were submitted to Second Nature, as part of complience with the *Carbon Commitment*[7], formerly known as the American College & University Presidents' Climate Commitment, or ACUPCC. While this data can provide a general point of comparison, great significance should not be placed on these comparisons due to the different data collection methods and accounting techniques employed by each school. Scope 3 emissions are the toughest to compare, since many schools only report on a few sub categories, if any at all. The most commonly reported Scope 3 categories, based on the small sample of Carbon Commitment participant reports viewed, are commuting, air travel, and solid waste. Due to its inclusion in the CCC, paper purchasing is the only commonly reported metric in the purchasing category.

The following chart shows the comparison of Barnard's total GHG emissions to the GHG reports of 7 selected colleges and universities. Figures shown in the chart are gross emissions, not net emissions for schools that participate in carbon off-setting programs, such as composting or the purchasing of Renewable Energy Certificates (RECs). Barnard was slightly above average for MT eCO_2 per full-time enrollment, and farther above average for MT eCO_2 per 1,000 square feet.

	Gross Emissions (MT eCO_2)					
	Scope 1	Scope 2	Scope 3	TOTAL	Per Full-time Enrollment	Per 1000 sq ft
Bard	7,199.00	4,905.00	6,517.00	18,621.00	9.4	15.7
Barnard	4,624.35	2,529.30	14,990.92	22,144.57	8.7	18.8
Bryn Mawr	3,350.00	7,411.00	5,189.00	15,950.00	9.4	12.6
The New School	4,283.00	8,402.00	797.00	13,482.00	1.3	9.9
Smith College	22,996.90	4,622.90	2,553.00	30,172.80	10.1	9.2
Swarthmore	5,769.50	7,826.00	3,808.96	17,404.46	11.3	11.0
UMass Boston	4,982.00	29,672.00	4,758.60	39,412.60	3.2	14.3
Union College	7,890.72	5,339.00	4,835.00	18,064.72	8.1	9.0
				AVERAGE	7.7	12.6

Of these 7 other institutions, Bryn Mawr's Scope 3 inventory was the most comprehensive, and therefore, the most similar to Barnard's. Bryn Mawr reported on commuting, air travel, solid waste, other directly-financed travel, Scope 2 T&D losses, and paper. If Barnard were to exclude food, student travel to/from home, and all "stuff" except for paper from the analysis, Scope 3 emissions

[7] http://reporting.secondnature.org/

would be 5,709.50 MT eCO2, compared to 5,189.00 MT eCO2 at Bryn Mawr. At 1,269,335 sqft, Bryn Mawr's campus is slightly larger than Barnard's, while serving fewer students.

If Scope 3 emissions are removed from the analysis, as in the chart below, Barnard performs much better compared to the average of these institutions. The Scope 1 and 2 emissions suggest that Bryn Mawr relies more heavily on electricity (Scope 2), while Barnard consumes a fair amount of natural gas (Scope 1). Smith College appears to be an outlier in Scope 1 emissions, which could be caused if Smith College still uses fuel oil as a primary energy source. For UMass Boston, the outlier in Scope 2, we do not have enough information to have any insight into the reason for their high electricity consumption. The New School and UMass Boston also have low emissions per full-time enrollment due to their large student bodies of 10,154 and 12,333, respectively.

Though there are many factors at play, Barnard is a relatively efficient energy consumer in terms of campus size and student enrollment.

	Gross Emissions (MT eCO_2)				
	Scope 1	Scope 2	TOTAL	Per Full-time Enrollment	Per 1000 sq ft
Bard	7,199.00	4,905.00	12,104.00	6.1	10.2
Barnard	4,624.35	2,529.30	7,153.64	2.8	6.1
Bryn Mawr	3,350.00	7,411.00	10,761.00	6.4	8.5
The New School	4,283.00	8,402.00	27,619.80	1.2	9.3
Smith College	22,996.90	4,622.90	13,595.50	9.2	8.4
Swarthmore	5,769.50	7,826.00	12,685.00	8.9	8.6
UMass Boston	4,982.00	29,672.00	34,654.00	2.8	12.6
Union College	7,890.72	5,339.00	13,229.72	5.9	6.6
			AVERAGE	5.4	8.8

Next Steps

In order to gain the most value from this project, we recommend that Barnard create a plan to conduct an annual survey to gather data for an ongoing Greenhouse Gas/Carbon Footprint inventory. Sending a survey to students, faculty, and staff will remove many of the assumptions applied to this study, especially in the travel-related categories.

Since conducting the GHG inventory is often the biggest hurdle, it would now be easy for Barnard to join Second Nature's *Carbon Commitment* or the *Climate Commitment*, which also includes a resiliency commitment. To date, over 650 colleges and universities have become a part of this Climate Leadership Network and collectively have avoided 3,771,497 MT eCO_2.[8] Barnard is already participating in programs such as NYSERDA's (New York State Energy Research and Development Authority) REV (Reforming the Energy Vision) Campus Challenge and the NYC Carbon Challenge[9], which share the goal of increasing energy efficiency and reducing GHG emissions. Joining the *Carbon Commitment* would be another way to show Barnard's dedication to the cause and further promote their involvement in the energy and sustainability arena.

Through participation in the NYC Carbon Challenge, Barnard has already made significant strides in reducing Scope 1 and Scope 2 emissions, reaching their initial 30% reduction goal in under 10 years. This was achieved mainly by terminating the use of fuel oil #6, which has a very high carbon coefficient, and switching to natural gas, which is much cleaner by comparison. Energy efficiency efforts will continue as Barnard works towards the extended 50% reduction goal. Since many energy efficiency upgrades have been made, behavioral changes will be necessary to reach this goal. Competitions between dorms or departments are often an effective method, inspiring energy reduction through friendly competition. Other campaigns, such as "Shut the Sash" campaigns, geared towards reducing the energy consumption of laboratory fume hoods, could be implemented to reduce energy use and carbon emissions.

Another way to reduce net GHG emissions from energy systems is to offset them. Purchasing Renewable Energy Certificates (RECs) is a popular, and relatively inexpensive way to do this. Many universities choose to offset all Scope 1 and Scope 2 emissions through the purchase of RECs. With energy cost savings derived from well executed energy supply purchasing in the deregulated market, it could even be possible to mitigate the cost of RECs.

The results of the study also highlight some areas to approach for reduction opportunities aside from the energy systems responsible for Scopes 1 and 2. Not only are food and solid waste some of the largest Scope 3 contributors, but they are also inherently linked. Excess un-eaten food releases emissions in production and transportation, as well as in disposal. Catering less also reduces the amount of waste by way of reducing distance travelled by food vendors and reducing the amount of

[8] http://secondnature.org/our-impact/network-snapshots/
[9] https://barnard.edu/news/barnard-college-participate-statewide-clean-energy-challenge

plastic cutlery, plate ware, napkins, soda bottles, etc. To mitigate these impacts, loose policies can be made that will reduce the amount of catering used, such as reducing the number of meetings held during lunch hours, or using reusable catering products. Before waste reduction can be comprehensively analyzed and overhauled, there needs to be improved reporting on current waste. Action Carting currently does not weigh each pick-up and record the weight of trash versus recyclables, but likely could report waste tonnage and diversion rates.

These are just some examples of action points that could lead to a reduction of GHG emissions. The following list of Action Points by Category offers some additional suggestions; however, it is by no means exhaustive, and many suggestions may not be feasible or in alignment with the overall mission of the college. With minimal effort and investment Barnard can continue to make progress in this area.

ACTION POINTS BY CATEGORY

A Stationary Combustion

Continue to invest in efficient boilers and other energy efficient technologies.
Educate and encourage students to reduce energy consumption through behavioral campaigns.

B Fleet Vehicles

Consider hybrid and/or electric vehicles for fleet replacements or additions.

C Purchased Electricity

Continue to invest in efficient boilers and other energy efficient technologies.
Educate and encourage students to reduce energy consumption through behavioral campaigns.
Offset carbon emissions of purchased electricity through the purchasing of Renewable Energy Certificates (RECs).

D Commuting

Create a carpooling or rideshare program/platform.
Offer incentives for carpooling and use of public transportation.
Create a bike share program.

E Directly-financed Travel

Reduce number of conferences or meetings attended and/or encourage telecommuting.
Encourage staff/faculty to offset their carbon emissions through their airline – an option now offered by most carriers.

F Study Abroad Air Travel

Encourage students to offset their carbon emissions through their airline – an option now offered by most carriers.

G Student Travel to/from Home

Create a carpooling program/platform/website/facebook group.

H Solid Waste

Require waste vendor to provide tonnage data for trash and recyclables.
Increase composting efforts.

I Food

Hold fewer meetings during lunch hours, reducing the need for catering.
Set a catering standard that reuses plates and silverware to reduce amounts going directly to landfills.

J Stuff

Have more swap events like Give-and-Go-Green take place throughout the year.
Find faculty, staff, or students with various skills who are willing to participate in a fix-it-up day.

K Scope 2 Line Losses

Emissions reductions in group C will lead to reductions in this category as well.

GENERAL ACTION POINTS

1. Create a Climate Action Plan to consolidate tracking of current energy and carbon reduction projects and plan for future initiatives.

2. Join The Climate Leadership Network and sign the Carbon Commitment (formerly known as the ACUPCC).

   Over 600 higher education institutions nationwide are a part of this network. Participation requires yearly GHG reporting, and occasional submission of Climate Action Plans.

3. Join the U.S. Department of Energy's Better Buildings Challenge

   The program requires the college to make a 20% energy use intensity reduction commitment and share basic energy use data in exchange for a platform of innovative solutions, program support, and access to technology accelerator programs. It also provides a good platform to display the college's successes through showcase projects.