University of Delaware

Greenhouse Gas Inventory for the 2011 – 2012 Academic Year

March 4, 2013

Introduction

The University of Delaware (UD) became a signatory to the American College & University Presidents' Climate Commitment (ACUPCC) in 2008. ACUPCC is a voluntary program designed to address global warming by documenting institutional commitments from college and universities to increase awareness around climate change and eliminate net greenhouse gas (GHG) emissions from their own operations. UD, as part of its ACUPCC requirements, submitted an initial GHG inventory report detailing its carbon emissions for the 2007-2008 academic year in 2009 and, in 2010, filed a Climate Action Plan specifying future emissions reduction targets.

The next action required by UD's commitments to the ACUPCC is to submit a GHG inventory for the 2011-2012 academic year. This report summarizes the results of UD's carbon accounting activities to date.

Overview of 2007-2008 GHG Inventory Approach and Results

UD's 2007-2008 academic year carbon inventory was compiled by a team of students and faculty in 2009. Data associated with building electricity consumption, natural gas and heating oil combusted at the university's utility plants, fuels utilized by university-owned fleet vehicles, waste produced, and fertilizer used was all contemplated in the carbon accounting exercise. The team also conducted a survey to evaluate the commuting habits of UD faculty, staff, and students in an effort to estimate this component of the institution's carbon footprint.

In addition to direct data gathering efforts for emission calculations, building audits were performed to develop estimated emission allocations by source activities such as lighting, heating, cooling and commuting.

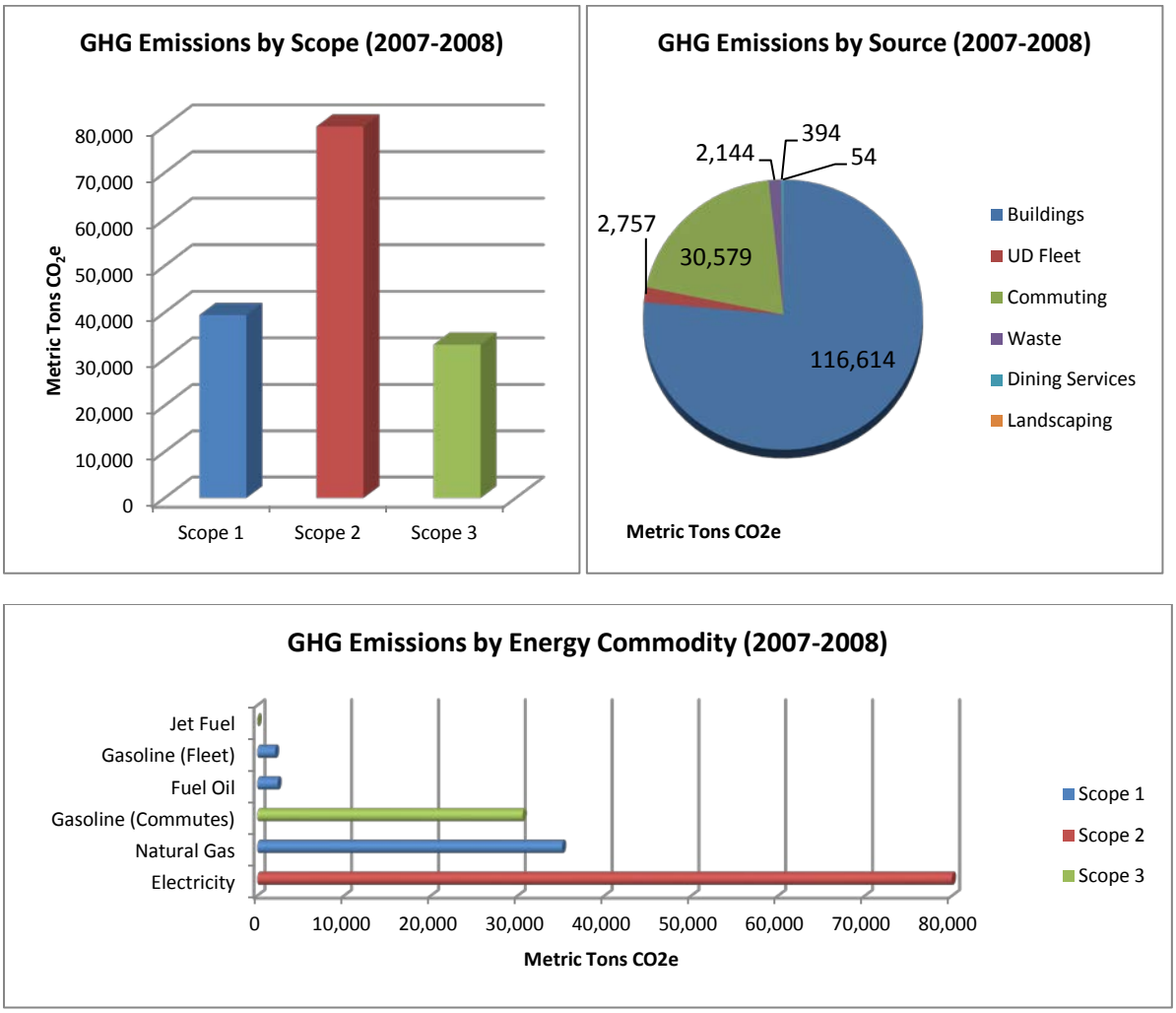
Several sources of UD GHG emissions had been excluded because sufficient data was unavailable, but these sources are de minimis and do not have a material impact on the organizational carbon footprint. The omitted activities include university-related ground travel where UD fleet vehicles were not utilized and air travel associated with UD business. Individuals commonly make their own travel arrangements precluding any ability to collect data on travel distances or trip frequencies.

The UD total GHG emissions for the 2007-2008 academic year were estimated to be 152,542 metric tons of carbon dioxide equivalent (MT CO_2e). Significant sources of emissions included purchased electricity (52%), combustion of natural gas (23%), and gasoline consumed by student/staff vehicles (20%). These results are summarized below by emissions scope[1], source, and energy commodity (Figure 1).

[1] The standard definitions of GHG emissions scopes is as follows:

- Scope 1 – direct GHG emissions; sources include stationary combustion, fleet vehicles, and process and fugitive emissions.
- Scope 2 – indirect GHG emissions; typically includes purchased electricity, steam, and chilled water.
- Scope 3 – other Indirect GHG emissions; sources include student, faculty and staff commuting, business travel, waste disposal, etc.

Figure 1: 2007-2008 GHG Emissions



Overview of 2011-2012 GHG Inventory Approach and Results

Pace Global, A Siemens Business (Pace Global), worked with UD personnel to compile the 2011-2012 academic year GHG inventory. The aim of this effort was to replicate the scope and approach of the 2007-2008 GHG inventory and generate a brief, written update for comparison to the 2007-2008 benchmark. This process allows for direct correlations between the two records while measuring the benefits of carbon mitigation actions taken during the intervening five years.

Direct data records were compiled for building energy use, UD owned fleet vehicles, organic waste outputs, and fertilizer used. Estimates were utilized to assess fuel consumption associated with commuting activities as was required for the 2007-2008 academic year GHG inventory. However, it was not practical to replicate the survey conducted during the 2007-2008 effort so the 2011-2012 commuting activity level was estimated by making adjustments the 2007-2008 value based on changes in student population, the number of parking permits issued, and national average fuel efficiency (see Appendix B for calculations.)

Emission factors for the combustion of natural gas, fuel oil, gasoline, diesel fuel, and jet fuel were obtained from the U.S. EPA Mandatory Reporting Rule for Greenhouse Gases (MRR), Table C-1, in keeping with the accounting methodology specified by The Climate Registry's *General Reporting Protocol (GRP)*. This represents a slight departure from the 2007-2008 approach which relied upon emission

factors from the U.S. Energy Information Administration (EIA). Another change is that methane (CH_4) and nitrous oxide (N_2O) emissions associated with fuel combustion were considered in the 2011-2012 report while only CO_2 emissions were documented in the 2007-2008 report. These modifications are warranted however, because they align UD's GHG accounting approach with current best practices and the resulting difference is less than 1% for all commodities, so this change does not substantially impact the emission totals.

Emissions factors for purchased electricity, in keeping with *GRP* methodology, were derived from the U.S. EPA's eGRID 2012 tables. Specifically, UD is located within the RFC East Subregion, so the published GHG emission factors representing the fuel mix used in generating electricity in this region were used. This source differs from the one used for the 2007-2008 report, but the eGRID system is a universally accepted source which is regularly updated so, adopting this standard will facilitate future emissions inventory calculations. It should be noted that the eGRID factor used for the current reporting year is approximately 26% lower than that used in the 2007-2008 report, but this reduction is attributable to cleaner electricity generation within the region. This is supported by literature from UD's electric utility which denotes changes to the mix of electricity generation plants over the past five years yielding a 22% decrease in GHG emissions per-kWh (Appendix C.)

Scope 3 GHG emissions from the disposal of mixed waste, food waste, and food composting were calculated using emission factors obtained from the U.S. EPA WARM Model, version 12. This is an updated version of the same source used in the 2007-2008 report.

GHG emissions resulting from usage of nitrogen fertilizer were calculated with an emission factor derived from the U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2001 (April 2003). This is the same value that was used in the 2007-2008 report.

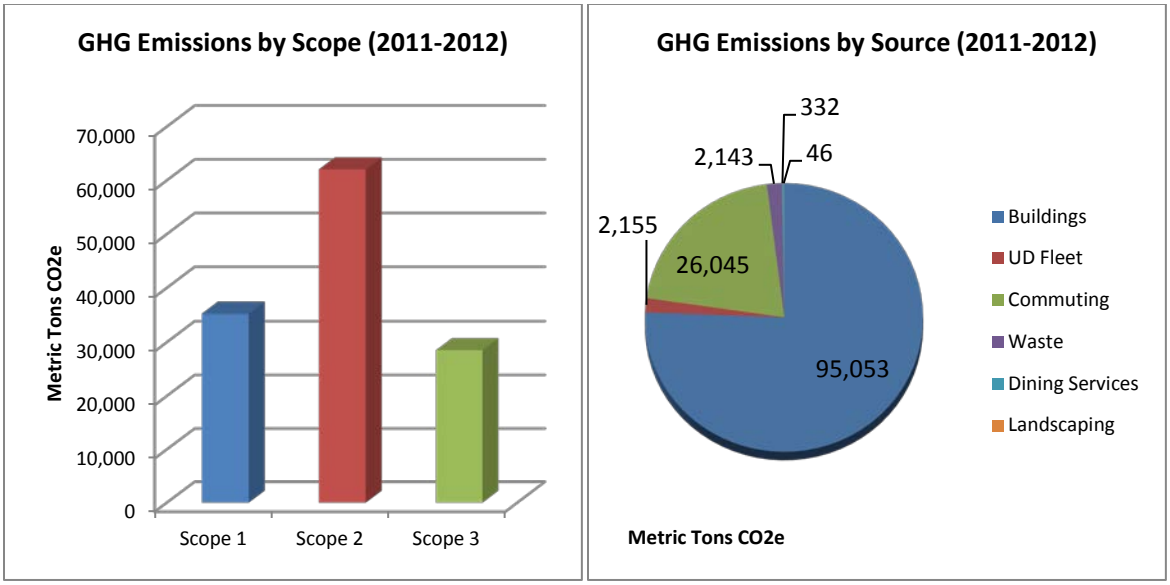
Pace Global's ecolink® tool was leveraged to assist with data management and emissions calculations. This platform ensures that all emissions factors are clearly documented and correctly applied. This tool also provides safe and transparent data warehousing which will allow UD to re-analyze its organizational carbon footprint or solicit external validation of the UD carbon accounting practices.

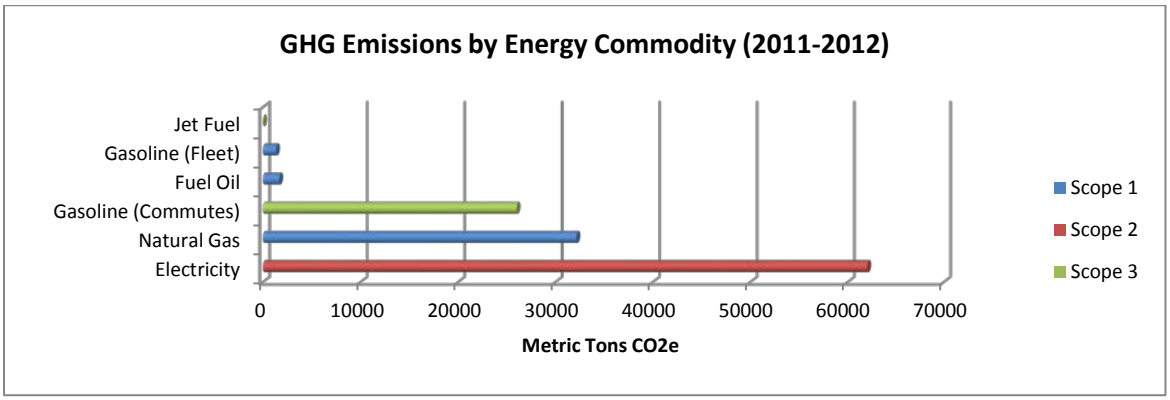
UD's 2011-2012 total GHG emissions were estimated at 125,773 MT CO_2e and detailed emission results by source are presented in Table 1 while Figure 2 provides a summary of the results by emissions scope, source, and energy commodity. Significant sources of emissions included purchased electricity (49% of the total), combustion of natural gas (26%), and gasoline consumed by student/staff vehicles (21%). Building audits were not repeated for the 2011-2012 inventory report so, source-specific allocations of emissions were not determined.

Table 1: 2011-2012 Total Consumption and GHG Emissions by Source

Source	Sector	Scope	Consumption	Unit	Emissions (MT CO_2e)
Natural Gas	Buildings	1	588,573	MCF	32,160
Fuel Oil #2		1	82,414	gal	846
Electricity		2	143,593,679	kWh	62,047
Gasoline	Transportation	1	152,171	gal	1,336
		3	2,964,455	gal	26,021
Diesel Fuel		1	80,228	gal	819
Jet Fuel		3	2,401	gal	23
Mixed Solid Waste	Waste	3	2,187	tons	2,143
Food Waste/Compost	Food Services	3	481	tons	332
Fertilizer	Landscaping	1	11,471	lb	46
Total Emissions:					125,773

Figure 2: 2011-2012 GHG Emissions





Comparison to 2007-2008 Results

UD's measured GHG emissions declined from 152,542 MT CO_2e during the 2007-2008 academic year to 125,773 MT CO_2e during 2011-2012. This GHG emissions reduction of 26,769 MT CO_2e represents an approximate 18% decline.

The most significant GHG emission decrease, not surprisingly, originated from UD's largest emission source, purchased electricity. Despite a 4% increase in the quantity of electricity consumed, the emissions associated with purchased electricity fell by 17,911 MT CO_2e, a 22% drop from 2007-2008. This accounts for 67% of the total reduction in GHG emissions since the 2007-2008 report.

Another emission source that accounted for a significant proportion of the 18% decline was Scope 3 transportation emissions, including student and staff commuting and dorm resident trips home. Based on decreases in parking permits issued, increases in national average fuel economy, and changes to enrollment, it was estimated that approximately 15% less fuel was consumed in 2011-2012 than in 2007-

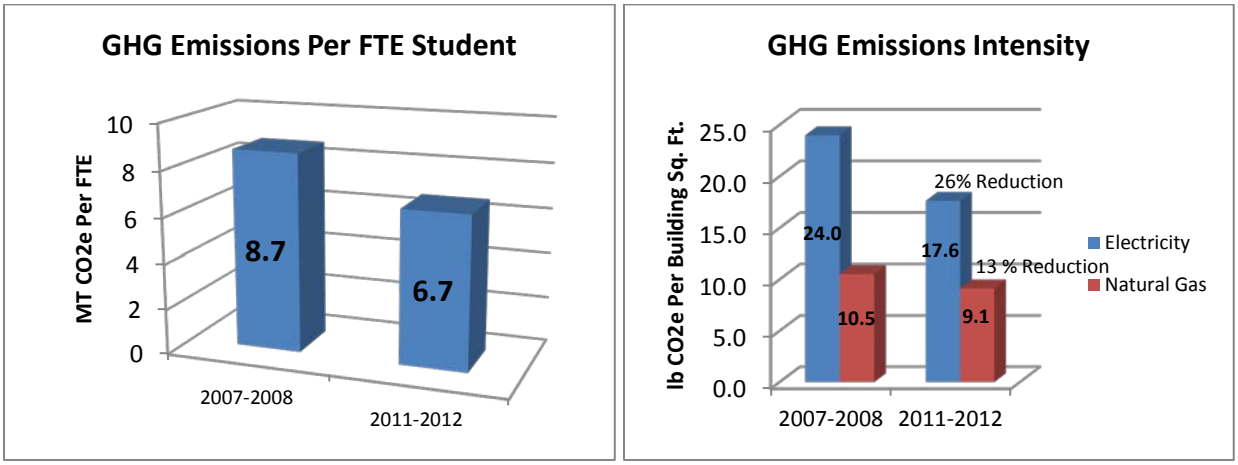
2008. This corresponds to a 15% decrease in emissions associated with commuting and trips home, and represents 17% of the total reduction in GHG emissions since the 2007-2008 report.

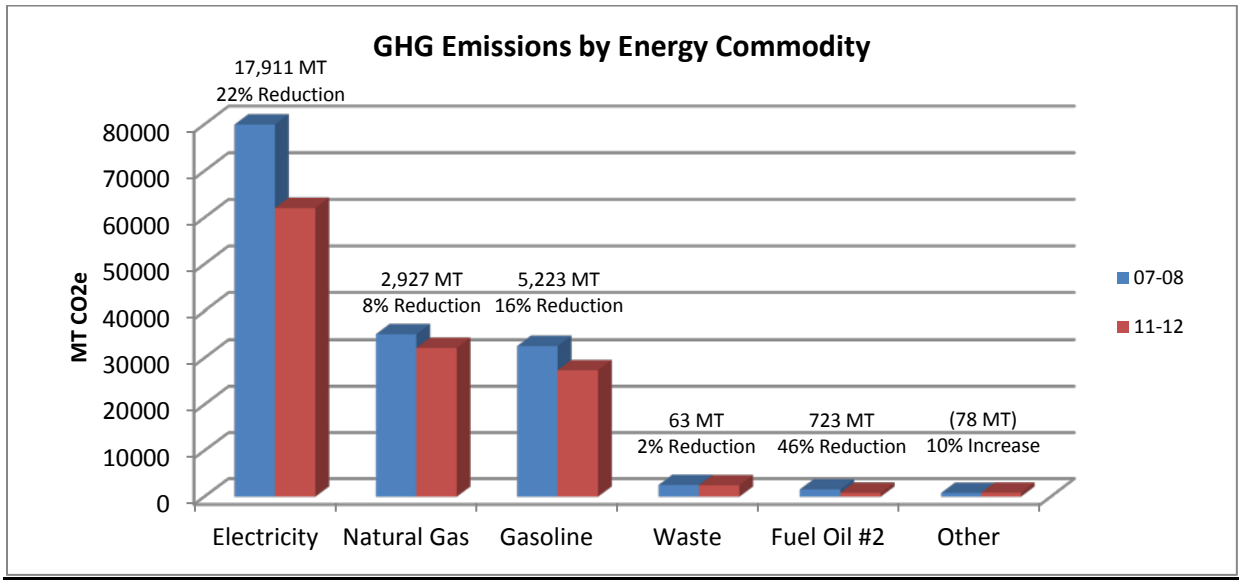
The final emission source that represented a substantial fraction of the emissions reductions was stationary combustion of natural gas. UD reduced its natural gas consumption by 8%, resulting in a corresponding 8% drop in associated GHG emissions. This accounts for 11% of the total reduction in GHG emissions since the 2007-2008 report.

These emissions reductions were achieved despite the fact that student enrollment at the University increased from 17,631 Full-Time Equivalents (FTE) in 2007-2008 to 18,713 FTEs in 2011-2012. In 2007-2008, 8.7 $MTCO_2e$ were emitted for each FTE student. In 2011-2012 that ratio dropped to 6.7 $MTCO_2e$ per FTE student, a decrease of 23%.

UD's aggregate building area also increased from 7,347,902 square feet in 2007-2008 to 7,757,543 square feet in 2011-2012. However, efficiencies caused the GHG emissions rate per building square foot to outpace this facility growth and emissions intensity fell by 26% for electricity (from 24.0 lb CO_2e per square foot to 17.6) and 13% for natural gas (from 10.5 to 9.1). These results are summarized in Figure 3.

Figure 3: 2007-2008 v 2011-2012 GHG Emissions Comparisons



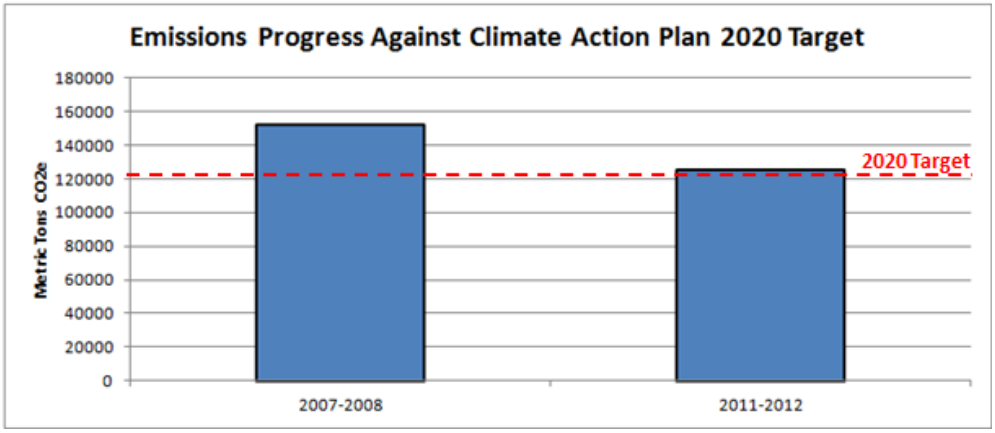


Progress Against Climate Action Plan

UD, as part of the ACUPCC Climate Action Plan, adopted emission reduction target milestones to be achieved by 2013 (a 5% reduction target from 2007-2008), 2015 (10%), and 2020 (20%).

The results of the 2011-2012 GHG inventory report, which identified a GHG emission reduction of 18%, UD has achieved both its 2013 and 2015 emissions reduction targets, and is within 1% of achieving its 2020 target.

Figure 4: Emissions Progress v. Climate Action Plan Target



Environmental Highlights

The reductions in greenhouse gas emissions that the University of Delaware has achieved over the past five years have been in attributable in part to a number of efforts aimed at cleaner power generation, energy efficiency and consumption reduction for both buildings and vehicles, and recycling initiatives. These projects and the associated environmental impacts are detailed below.

Energy Efficiency:

1. 18 variable speed drives were installed at the air handlers to reduce electricity consumption by 1,064,078 kWh annually. Five additional variable speed drive installations are in progress and nine additional drives are planned for installation. Annual emissions reduction due to the 18 operational drives: **460 $MTCO_2e$**
2. A University of Delaware Energy Revolving Loan Fund was used to finance a multi-building lighting project which reduced electricity consumption by 935,192 kWh annually. Annual emissions reduction: **404 $MTCO_2e$**
3. An Automatic Blowdown Control System was installed in Worrilow Boiler #3, reducing natural gas consumption by 5,678 MCF annually. Annual emissions reduction: **310 $MTCO_2e$**
4. GES retrofit kits for 570 100W metal halide canopy light fixtures were installed in three parking garages (Academy Street, Trabant University Center, and CFA,) reducing electricity consumption by 349,524 kWh annually. Annual emissions reduction: **151 $MTCO_2e$**
5. A reduction in usage of the Summer Standy boiler reduced natural gas consumption by 1,320 MCF annually. Annual emissions reduction: **72 $MTCO_2e$**
6. A campus utility metering project will enhance UD's ability to track and analyze its energy consumption patterns. This project does not directly yield any emissions savings but will enable UD to identify opportunities to increase efficiency

Total Annual Reduction from Energy Efficiency Projects: ***1,397 MT CO2e***

Renewable Energy:

1. A wind turbine was installed with the capacity to generate up to 5.5 million kWh of electricity annually, which is more than sufficient to power the entire Lewes campus. Annual emissions reduction: **up to 2,377 $MTCO_2e$**
2. The University has committed to a long term purchase price agreement for solar energy. The largest rooftop solar panel array in Delaware state history was installed at the Delaware Field House, and panels were also installed at Clayton Hall, and 461 Wyoming Road, which will produce a combined 1,089,011 kWh annually. Annual emissions reduction: **471 $MTCO_2e$**

Total Annual Reduction from Renewable Energy Projects: ***2,848 $MTCO_2e$***

Waste and Recycling:

1. Interdisciplinary Science & Engineering Building construction waste is being recycled. 1,356 tons or 86% of the construction byproducts waste has been recycled, diverting it from the landfill. Annual emissions reduction: **1,329 $MTCO_2e$**
2. 1,058 tons of trash, representing 32.6% of total trash, has been recycled in fiscal year 2012 through a campus-wide single-stream recycling program. Annual emissions reduction: **1,037 $MTCO_2e$**
3. East Campus Residence Halls' construction waste was recycled. 722 tons or 85% of the construction byproducts waste was recycled. Annual emissions reduction: **707 $MTCO_2e$**

Total Annual Reduction from Waste and Recycling Projects: ***3,073 $MTCO_2e$***

New Construction Efforts:

1. The Interdisciplinary Science & Engineering Building (ISE) Lab was constructed to achieve, at minimum, the standards of the U.S. Green Building Council's LEED[2] Silver designation. This represents a significant investment in environmentally friendly products, equipment and design standards. Energy savings are projected to be 29.3% per year had Green initiatives not been taken. Annual emissions reduction: **184 MTCO2e**. Green elements include:

    a. 425,582 kWh in savings because of Green initiatives
    b. Construction waste is being recycled via single stream recycling.
    c. There are three green roofs.
    d. The courtyard landscape utilizes native plants and an onsite drainage system, eliminating stormwater runoff.
    e. Fume hoods provided with proximity sensors
    f. Variable frequency drives on fans/pumps
    g. Heat pipe/heat wheel energy recovery in air handling units
    h. Heat recovery from East Campus Utility Plant (ECUP)
    i. Static pressure reset on air handling unit supply fans
    j. Chilled & heating water temperature reset for HVAC systems
    k. Occupancy sensors to control ventilation air flow (and lighting)
    l. Premium efficiency motors

[2] LEED is an internationally recognized voluntary green building program. Buildings designed to LEED Standards:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions

m. Demand control ventilation
n. Air side economizer control programs for non-lab air handling systems
o. Energy efficient lighting
p. Automatic, digital lighting control system – this information already provided!
    i. Occupancy/vacancy sensing
    ii. Astronomical timeclock scheduling
    iii. Daylight harvesting
    iv. Dimming
    v. High-end trim of light levels
    vi. Load shedding and demand response capabilities
q. Automated window shade controls
r. Enhanced commissioning to verify system installation and performance

2. Life Sciences – LEED[1] certified building
3. BCC – LEED[1] silver equivalent building
4. East Campus Residence Halls – LEED[1] silver equivalent building
5. East Campus Utility Plant

Total Annual Reduction from New Construction Efforts: ***184 MTCO$_2$e***

Sustainable Transportation Efforts:

1. Reduction in number of vehicles traveling to UD – the number of parking permits issued has dropped by 530 from FY2009 – FY2013. The resulting decrease in fuel consumption by travelers to UD equates to an annual emissions reduction of: **4,537 MTCO$_2$e**
2. Maintenance & Operations traded in four 2001 Dodge vans for four 2011 Ford Transit Connect vans. The newer vans have twice the efficiency over the older vans, which results in a 50% reduction in GHG emissions. Annual emissions reduction: **16 MTCO$_2$e**
3. Beginning in the spring of 2013, five BMW Mini-E electric vehicles will be leased. Annual emissions reduction: **15 MTCO$_2$e**
4. The motor pool rental fleet has added 8 hybrid vehicles. Annual emissions reduction: **15 MTCO$_2$e**
5. Two fuel cell buses were added. These buses emits zero greenhouse gases, are significantly quieter than typical diesel transit buses, and get better gas mileage (11 miles per diesel gallon equivalent for the fuel cell bus, compared to approximately 5.5 mpg for a similarly sized diesel transit bus). Annual emissions reduction: **7 MTCO$_2$e**
6. GPS Locators and real-time tracking apps have been implemented to improve and expand the shuttle service.
7. UD has secured funding to improve bicycle infrastructure (additional bike racks, cover bike shelters, etc.) with implementation scheduled for summer 2013.
8. UD Shuttles feature bike carriers to encourage bike use.
9. In an effort to increase carpooling, all carpoolers are eligible for guaranteed ride home through partnership with Rideshare Delaware. Number of daily passes provided to carpoolers was increased to 40 as recommended in the 2008 climate action plan. Number of carpool permits has risen from 41 in FY2009 to 98 in FY2013.
10. UD maintains a fare-free shuttle service to encourage bus use and to discourage car use.
11. UD offers car sharing services through partnership with Zipcar.
12. UD has brought Megabus and Greyhound to campus which encourages mass transit travel to and from UD and the Newark metro area.

Total Measured Annual Reduction from Sustainable Transportation Efforts: ***4,590 MTCO$_2$e***

Across all categories of UD environmental initiatives, the total measured emission reduction achieved is:

12,092 metric tons of CO_2e

Appendix A: Data

Emission Factors:

Scope	Source	Commodity	Usage	Unit	CO2 Factor	CO2 Unit	CH4 Factor	N2O Factor	CH4/N2O Unit
1	Building	Natural Gas	588,573	MCF	0.0545	Kg/CF	5	0.1	g/mmBtu
1	Building	Fuel Oil #2	82,414	Gal	10.21	Kg/gal	11	0.6	g/mmBtu
1	Fleet	Gasoline	152,171	Gal	8.7775	Kg/gal	0.000788	0.0008717	g/gal
1	Fleet	Diesel	80,228	Gal	10.21	Kg/gal	0.000027	0.0000531	g/gal
1	Landscaping	Fertilizer	11,471	lb	0.004	MT/lb			
2	Building	Electricity	143,593,679	kWh	947.42	lb/MWh	26.84	14.96	lb/GWh
3	Waste	MSW	2,187	Tons	0.98	MT/ton			
3	Waste	Food Comp.	44	Tons	0.69	MT/ton			
3	Waste	Dining Waste	437	Tons	0.69	MT/ton			
3	Commuting	Gasoline (Daily)	2,718,204	Gal	8.7775	Kg/gal	0.000788	0.0008717	g/gal
3	Commuting	Gasoline (Trips)	246,250	Gal	8.7775	Kg/gal	0.000788	0.0008717	g/gal
3	Commuting	Jet Fuel (Trips)	2,401	Gal	9.5684	Kg/gal	0.27	0.31	g/gal

Emission Totals (Metric Tons):

Scope	Source	Commodity	CO2	CH4	CH4 CO2e	N2O	N2O CO2e	Total CO2e
1	Building	Natural Gas	32,077	3.0253	63.5	0.06051	18.8	32,160
1	Building	Fuel Oil #2	841	0.1251	2.6	0.00682	2.1	846
1	Fleet	Gasoline	1,336	0.00012	0.003	0.00013	0.04	1,336
1	Fleet	Diesel	819	0.000002	0.00004	0.000004	0.001	819
1	Landscaping	Fertilizer	46					46
2	Building	Electricity	61,708	1.7482	36.7	0.9744	302.1	62,047
3	Waste	MSW	2,143					2,143
3	Waste	Food Comp.	30					30
3	Waste	Dining Waste	302					302
3	Commuting	Gasoline (Daily)	23,859	0.00214	0.04	0.00237	0.7	23,860
3	Commuting	Gasoline (Trips)	2,161	0.00019	0.004	0.00022	0.07	2,162
3	Commuting	Jet Fuel (Trips)	23	0.00065	0.01	0.00074	0.2	23

Notes:

Sources: EPA Final Mandatory Reporting of Greenhouse Gases, Table C-1 (CO2 factors for Natural Gas, Fuel Oil, Gasoline, Diesel, Jet Fuel), EPA Climate Leaders (CH4/N2O factors for Gas, Fuel Oil, Gasoline, Diesel, Jet Fuel), EPA Inventory of Emissions and Sinks (Fertilizer), EPA WARM Model v12 (MSW Waste, Food Waste), EPA eGRID (Electricity)

CO_2e calculations are based on IPCC Global Warming Potential Factors (CH_4 = 21; N_2O = 310)

Fertilizer and Waste emission factors are expressed in their source documents terms of CO_2e.

For Natural Gas and Fuel Oil #2, heat content values of 1.028 mmBtu/MCF and 0.138 mmBtu/gal, respectively, were assumed (EPA).

CH_4 and N_2O factors for transportation emissions are mileage-based in sources, and have been converted to volume-based factors based on national average fuel economy.

Appendix B: Scope 3 Transportation Estimates

Below are the estimates of fuel consumption associated with student and staff commuting, and with dorm room resident trips home during 2007-2008. These estimates were based on a University transport survey conducted in 2008:

Daily Commutes (gasoline): 3,213,717 gallons

Dorm Resident Trips Home (gasoline): 256,900 gallons

Dorm Resident Trips Home (jet fuel): 2,162 gallons

Because insufficient information was available about the data used and assumptions that were made to produce these estimates, it was determined that rather than creating new estimates from scratch for the 2011-2012 inventory report, the above values would be adjusted according to some relevant statistics.

Daily Commutes (gasoline): According to the University of Delaware Parking and Transportation Services, the number of annual parking permits sold dropped from 10,242 to 9,712 during the past five years (a 5.2% decline), indicating a decrease in the number of commuting vehicles. Additionally, according to a University of Michigan study, the US average fuel economy for cars and light trucks increased from 20.5 MPG in December 2007 to 22.6 in December 2011, an increase of 10.2% (see link below.) The 2007-2008 quantity of gasoline consumption was adjusted downward by these proportions for an estimated 2011-2012 value of 2,718,204 gallons of gasoline attributable to commuting.

Fuel Economy Study:

http://www.umich.edu/~umtriswt/EDI_sales-weighted-mpg.html

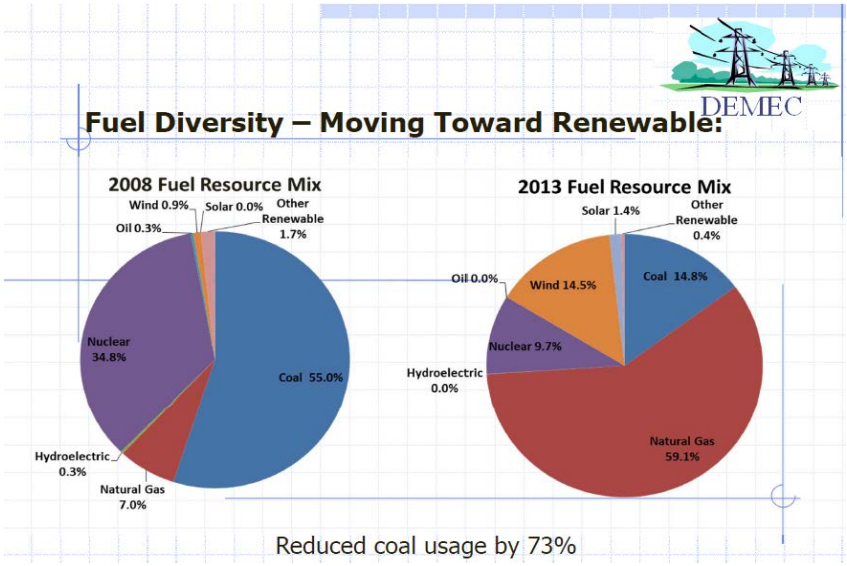
Dorm Room Trips Home (gasoline): According to the University of Delaware facts and figures page (http://www.udel.edu/IR/fnf/resid.html) the total University population of students plus employees increased by 6.1% between 2007-2008 and 2011-2012, so a corresponding 6.1% increase in the quantity of gasoline consumed on trips home was assumed. This was more than offset by increases in the national average fuel economy (see above), so the adjusted estimate for gasoline consumption attributable to trips home in 2011-2012 was 246,250 gallons.

Dorm Room Trips Home (jet fuel): It was assumed that all air trips home were undertaken by non-resident students. According to the facts and figures page (see above) the number of non-resident students increased by 11.0% between 2007-2008 and 2011-2012. So, the quantity of jet fuel consumed on trips home was adjusted upward by 11.0% for a new value for 2011-2012 of 2,401 gallons.

Appendix C: Electricity Generation Mix

When the University of Delaware's carbon inventory report was compiled for the 2011-2012 academic year, the emission factor applied to the consumption of purchased electricity was sourced from the EPA's eGRID. This was a change to the emission factor source used in the 2007-2008 inventory report, and represents a decrease of approximately 26% in terms of CO2 emissions per kWh.

Since cleaner purchased electricity accounted for such a large proportion in UD's measured emission reductions between 2007-2008 and 2011-2012, there exists the potential for concern that much of this reduction was not real, but simply an artifact of switching emissions factors. However, there is reason to believe that at least a significant portion of the 26% reduction is real and does in fact correspond to a cleaner generation mix serving Delaware's area. Below is a chart provided by DEMEC, UD's electric utility, followed by a breakdown quantifying the effect of these changes to the fuel resource mix on CO_2 emission rates:



Fuel	Share of Generation 2008	Share of Generation 2013	kg CO_2/MMBtu*	kg CO_2/Primary MMBtu 2008	kg CO_2/Primary MMBtu 2013
Coal	55.0%	14.8%	94.38	51.91	13.97
Natural Gas	7.0%	59.1%	53.02	3.71	31.33
Nuclear	34.8%	9.7%	0.00	0.00	0.00
Oil (#6)	3.0%	0.0%	75.10	2.25	0.00
Renewable	0.2%	16.4%	0.00	0.00	0.00
				57.87	**45.30**
				% change:	**-21.7%**

**EPA Final Mandatory Reporting of Greenhouse Gases Rule Table C-1*

DEMEC's claimed changes to their generation mix would represent a 21.7% decrease in emissions associated with electricity generation. This would appear to justify most of the 26% decrease to the emission factor associated with the University of Delaware's electricity purchases.

For comparison, the emissions factor associated with the RFC East Subregion (the eGRID Subregion containing Delaware) declined by 17% between the publication of the 2007 eGRID and the 2012 eGRID. If the 2007 eGRID factor is applied to the 2007-2008 electric usage rather than the factors that were used, UD's emissions reduction between 2007-2008 and 2011-2012 would work out to approximately 13%.

Appendix D: ACUPCC GHG Report Inputs

Below are the input values for 2011-2012 for the ACUPCC GHG Report:

Summary Statistics:

	Total (MT CO2e)	Per Full-Time Enrollment	Per 1000 Square Feet	% Offset
Gross Emissions (Scope 1 + 2)	97,254	5.2	12.5	0%
Gross Emissions (Scope 1 + 2 + 3)	125,773	6.7	16.2	0%
Net Emissions	125,773	6.7	16.2	N/A

Emissions Inventory Methodology and Boundaries:

Start date of the 12-month period covered in this report:

July 1, 2011

Consolidation methodology used to determine organizational boundaries:

The University of Delaware greenhouse gas inventory covered all buildings which the university controls operations at on its Newark Campus.

Emissions inventoried in this study address activities at the Newark Campus of the University of Delaware. This includes Laird Campus, the Main Campus, and South Campus. UD's off campus farm facilities were outside of the scope of this inventory, as were its Dover, Wilmington, Lewes and Georgetown satellite campuses.

Emissions calculation tool used:

ecolink™ by Pace Global, a Siemens Business

Please describe why this tool was selected.

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Please describe the source(s) of the emissions coefficients used.

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GHG emissions resulting from usage of nitrogen fertilizer were calculated with an emission factor derived from the U.S. EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2001 (April 2003).

Which version of IPCC's list of global warming potentials did you use?

Second Assessment Report

Who primarily conducted this emissions inventory?

Pace Global, A Siemens Business

Please describe the process of conducting this inventory.

Pace Global, A Siemens Business (Pace Global), worked with UD personnel to compile the 2011-2012 academic year GHG inventory. The aim of this effort was to replicate the scope and approach of the 2007-2008 GHG inventory and generate a brief, written update for comparison to the 2007-2008 benchmark. This process allows for direct correlations between the two records while measuring the benefits of carbon mitigation actions taken during the intervening five years.

Direct data records were compiled for building energy use, UD owned fleet vehicles, organic waste outputs, and fertilizer used. Estimates were utilized to assess fuel consumption associated with commuting activities as was required for the 2007-2008 academic year GHG inventory. However, it was not practical to replicate the survey conducted during the 2007-2008 effort so the 2011-2012 commuting activity level was estimated by making adjustments the 2007-2008 value based on changes in student population, the number of parking permits issued, and national average fuel efficiency.

Please see the formal inventory for further detail.

Please describe any emissions sources that were classified as de minimis *and explain how a determination of the significance of these emissions was made.*

No emissions sources were excluded due to being classified as *de minimis*.

Please describe any data limitations related to this submission and any major assumptions made in response to these limitations.

Several sources of UD's emissions are excluded because of a lack of sufficient data. The omitted activities include: UD related ground travel for which the UD fleet was not used; and UD related air travel. At UD, it is common for individuals to make their own travel arrangements, which precludes any ability to collect data on number of miles traveled or frequency of trips. Furthermore, the UD transportation survey scope only extended to travel around campus. Obtaining UD-related travel data from individuals was deemed infeasible at this time.

In addition, data limitation prevented UD from estimating the potential value of carbon sinks due to UD vegetation.

Emissions Data:

all values in MT CO2e

Scope 1 Emissions

Stationary Combustion	33005.7
Mobile Combustion	2154.9
Process Emissions	0.0
Fugitive Emissions	45.9
Total Scope 1 Emissions	**35206.5**

Scope 2 Emissions

Purchased Electricity	62047.1
Purchased Heating	0.0
Purchased Cooling	0.0
Purchased Steam	0.0
Total Scope 2 Emissions	**62047.1**

Scope 3 Emissions

Commuting	26021.4
Air Travel	23.2
Solid Waste	2475.2
Total Scope 3 Emissions	**28519.7**

Biogenic Emissions

Biogenic Emissions from Stationary Combustion	0.0
Biogenic Emissions from Mobile Combustion	0.0

Mitigation Data:

N/A

Normalization and Contextual Data:

Building space

Gross square feet of building space	7,757,543
Net assignable square feet of laboratory space	1,251,429
Net assignable square feet of health care space	27,265
Net assignable square feet of residential space	2,067,137

Population

Total Student Enrollment (FTE)	18,713
Residential Students	No information provided
Full-time Commuter Students	No information provided
Part-time Commuter Students	No information provided
Non-Credit Students	No information provided
Full-time Faculty	No information provided
Part-time Faculty	No information provided
Full-time Staff	No information provided
Part-time Staff	No information provided

Other Contextual Data

Endowment Size	No information provided
Heating Degree Days	No information provided

Cooling Degree Days	No information provided

Supporting Documentation:

(link to inventory here)

Auditing and Verification:

These emissions data have not been audited, verified, or peer-reviewed.