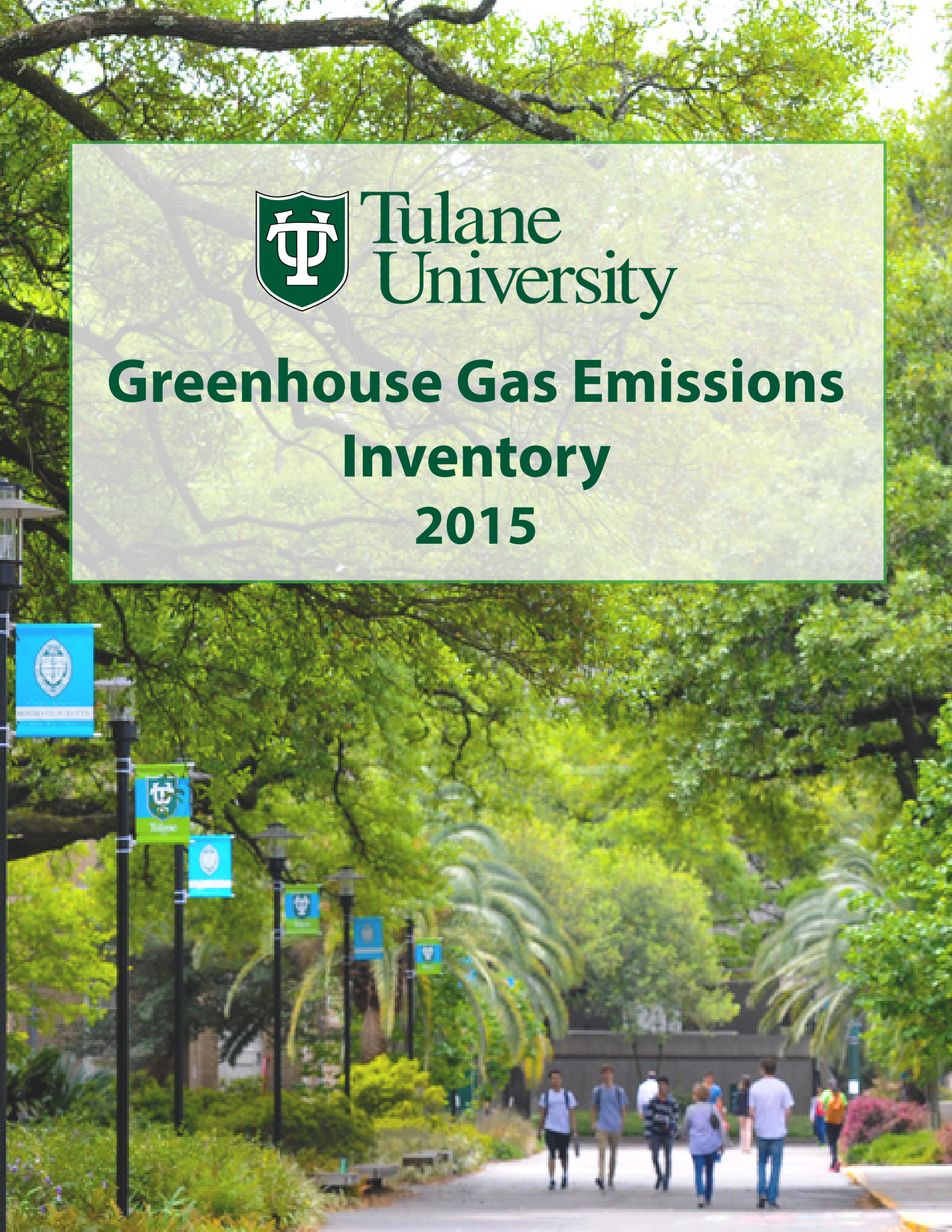


Tulane University

Greenhouse Gas Emissions Inventory 2015

Introduction

Measuring Greenhouse Gas & Climate Impact at Tulane

Since 2006, Tulane University has conducted an annual Greenhouse Gas (GHG) emissions inventory, tracking the emissions of GHGs that result from university activities as a way to measure our impact on climate change. The inventory provides valuable insight on the effectiveness of Tulane's efforts to address climate change and areas to pinpoint in reducing GHG emissions. This report is result of the most recent GHG inventory for the 2015 calendar year.

In 2008, Tulane joined the American College and University Presidents' Climate Commitment (ACUPCC), pledging to measure impact on climate change and develop a climate action plan along with universities throughout the country. Yearly greenhouse gas inventories for participating universities are published on secondnature.org.

In 2015, Tulane adopted the Tulane University 2014 Climate Action Plan, which presents a high-level quantitative analysis of the costs and savings of possible measures to reduce greenhouse gas emissions. It proposes short, medium, and long term strategies, ultimately reaching climate neutrality by the year 2050. The plan sets the 2007 GHG emissions inventory as a baseline year for GHG emissions, calling for a 15% reduction by 2020, and a 30% reduction by 2025. An Energy Management Committee, including staff from Facilities Services, University Planning, and Sustainability, was created to begin review and implementation of energy efficiency measures.The Climate Action Plan can be found at http://green.tulane.edu/climate-commitment.html.

2015 Energy Saving Actions

The following actions were taken in 2015 to reduce Tulane's energy use and, as a result, GHG emissions.

Uptown Power Plant Analysis Facilities Services began evaluation of major recommendations related to the Uptown campus power plant and energy distribution systems. Various approaches for efficient operation of the co-generation equipment are currently being analyzed and a project proposal for chiller optimization has been completed.

Energy Monitoring Tulane continued the installation of meters to measure building energy use, and adopted a software tool that allows Facilities managers to monitor and analyze building energy use. A user-friendly, online "Building Dashboard" was launched to make energy use data for key buildings available to students and faculty. The dashboard can be found at http://buildingdashboard.net/tulane/#/tulane

Lighting Retrofits Facilities Services studied lighting retrofit options and adopted a new standard of replacing lamps in existing fixtures with 25 W fluorescent lamps.

Sustainable Operations and Maintenance Manual A manual which includes guidelines for energy-efficient operation of buildings was completed.

Weatherhead Hall Audit A pilot Building Energy Audit was conducted at Weatherhead Hall.

Advanced Space Scheduling A system that coordinates room reservation calendars with temperature settings is being tested at Yulman Stadium.

RecycleMania 2015 Res Hall Challenge included energy savings as one of the competition's three categories.

Winter Break Shutdown This program was implemented during the closure of the university between the Christmas and New Year's holidays, placing most buildings into an energy-saving unoccupied mode.

Terms to Note

Greenhouse Gas

Greenhouse Gases trap heat within earth's atmosphere, which leads to changes in temperature and climate. They are released by a multitude of human activities, which are further addressed in this report, the most prominent being the burning of fossil fuels.

The Clean Air-Cool Planet (CA-CP) Campus Carbon Calculator measures seven types of greenhouse gases, including carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride.

Emissions Scopes

In GHG emissions reporting, emissions are divided into 3 scopes, depending on the institution's level of responsibility. Scopes 1 and 2 are most relevant, as they result from the university's use of energy and GHGs, such as refrigerants.

Direct emissions from the institution including stationary and mobile fossil fuel and combustion. This includes natural gas, propane, university fleet emissions, and refrigerants.

Indirect emissions resulting from electricity, steam, and chilled water purchased by the university from a utility.

Indirect emissions that are not directly released on campus, but result from university activities, including student and staff commuting, air travel (including study abroad), business travel, and solid waste disposal.

Units of Measurement

Global Warming Potential (GWP) Each GHG contributes to the trapping of heat in the earth's atmosphere at a different rate, and is assigned a GWP based on this rate.

Metric Tons of Carbon Dioxide Equivalent (MTeCO2) GHG emissions are measured in MTeCO2. Although there are multiple types of greenhouse gasses, carbon dioxide is the most common, and therefore easiest to compare its equivalent measurements from other gasses. The GWP is used to convert each type of greenhouse gas into the carbon dioxide equivalent in order to compare numbers at a standard rate. The Campus Carbon Calculator used for this analysis converts all measurements to MTeCO2.

Results

GHG emissions in 2015 totaled 133,698 MTeCO2. This is an increase from 2014 totals, and the highest GHG emissions since 2010. General trends are shown in Figure 1. The 2020 emissions goal of a 15% reduction from 2007 totals is illustrated with the dotted red line at 122,494 MTeCO2. Table 1 examines the ratios of emissions to floor area and student population. Over time, student population and building space have increased. During these years, both emissions per student as well as per building space have decreased. Both the Emissions per student and building area, however, are greater than average emissions for other similar schools participating in the ACUPCC.

Figure 1: Total Net Emissions (MTeCO2)

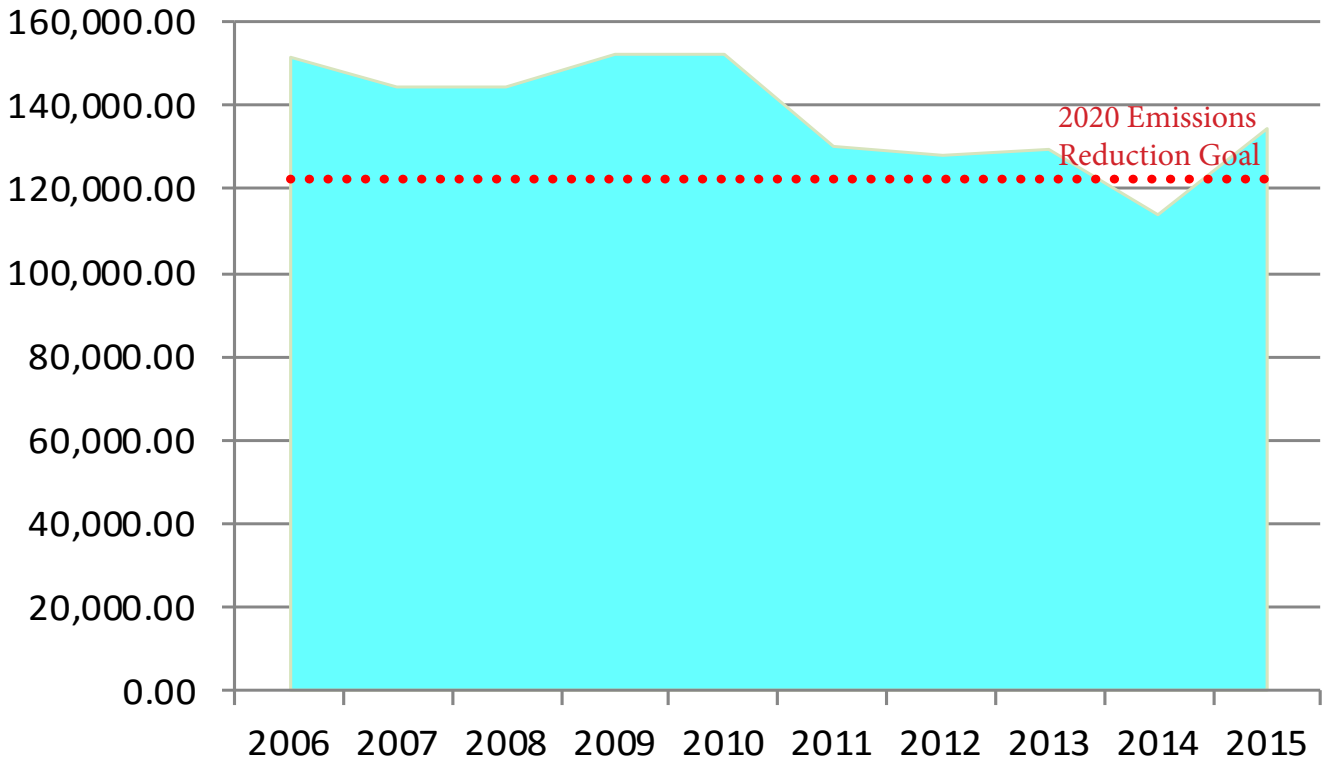


Table 1: Normalized Emissions

	Normalized Emissions									
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**ACUPCC Average**
Full Time Student Equivalent (Full Time + 1/2 Part Time)	9641	10091	10695	10945	12034	11699	12248	12341	12293	
MTcO2e/ FTE Student	**14.95**	**14.33**	**14.21**	**13.91**	**10.83**	**10.95**	**10.59**	**9.22**	**10.88**	**7.08**
Building Area (1,000 sq. ft.)	6747	7038	7156	7168	7193	7210	7210	7475	7297	
MTcO2e/ 1,000 sq. ft.	**21.36**	**20.54**	**21.23**	**21.24**	**18.13**	**17.78**	**17.99**	**15.22**	**18.32**	**16.76**

Results

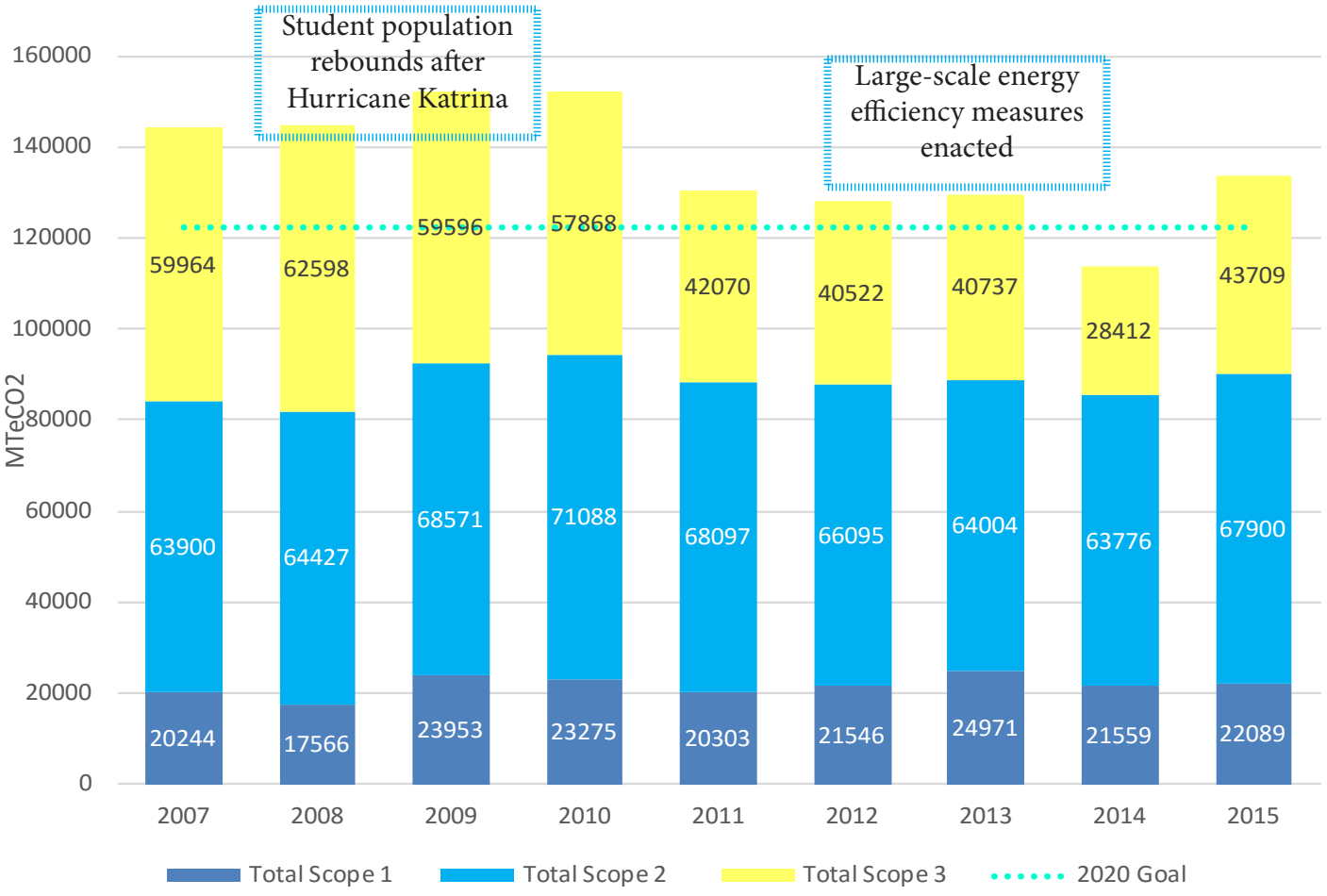
Emissions according to Scope

Figures 2 and 3 demonstrate the division of GHG emissions according to scope, as well as trends over time. Overall emissions have increased by 18% since 2014, while emissions from Scopes 1 & 2 have increased by 5% from 2014 totals. The 2014 report cites a large margin for error in its Scope 3 emissions data due to the very low business travel totals that were reported for the year in comparison to previous years.

Scope 1 & 2 emissions, which have increased by 5% since 2014, primarily result from the use of natural gas and electricity. This indicates a need for additional efforts to increase the energy efficiency of university buildings.

Scope 3 emissions are other indirect emissions not included in scope 2. These include commuting, business travel, waste disposal, and transmission and distribution losses (the loss of energy during delivery between the power plant and the building of use). The largest source of emissions within this category is from directly financed air-travel. This scope has increased significantly from 2014 but remains relatively stable in comparison to 2011, 2012, and 2013 totals.

Figure 2: Emissions by Scope



Notable Changes in 2015

New Construction & Additional Building Space

Several facilities were added to Tulane during 2015, increasing demand for energy and, in conjunction, GHG emissions.

Tulane City Center- 7,000 sq. ft. historic building in Central City purchased by Tulane, renovated and opened in August 2014.

Stephen Paul Jacobs House- This 720 sq. ft. home donated to Tulane in 2014, used as a residence for visiting faculty and a venue for architecture school functions.

Yulman Stadium- 239,395 sq. ft. campus stadium opened in September 2014, significantly contributing to overall energy use on the uptown campus. LEED Silver certified.

Greenbaum Residence Hall- New 80,000 square foot residence hall opened in August of 2014. Houses 256 students in 144 rooms, includes a living room, demonstration kitchen, classroom, social and study lounges, entry lobby, and courtyard. LEED Gold certified.

Center for Jewish Life- 10,000 sq. ft. restaurant and classroom space built in 2011, but recently added to Tulane's list of managed facilities.

Vivarium at the Health Sciences Center-The downtown health sciences center shut down its vivarium in October of 2013 and reopened it in October of 2014. This section of the facility has a very intensive energy use.

Biloxi Campus

This new facility was completed and in use in September 2015 and is certified LEED Gold. The campus replaced old classroom facilities, which were located in the Edgewater Shopping Mall in Biloxi. The new facility is 14,439 square feet as compared to the old facility which was 8,000 square feet. According to campus staff, despite the 180% increase in size, the building's electricity bill on average is $67 less each month than in the previous facility.

Building Square Footages

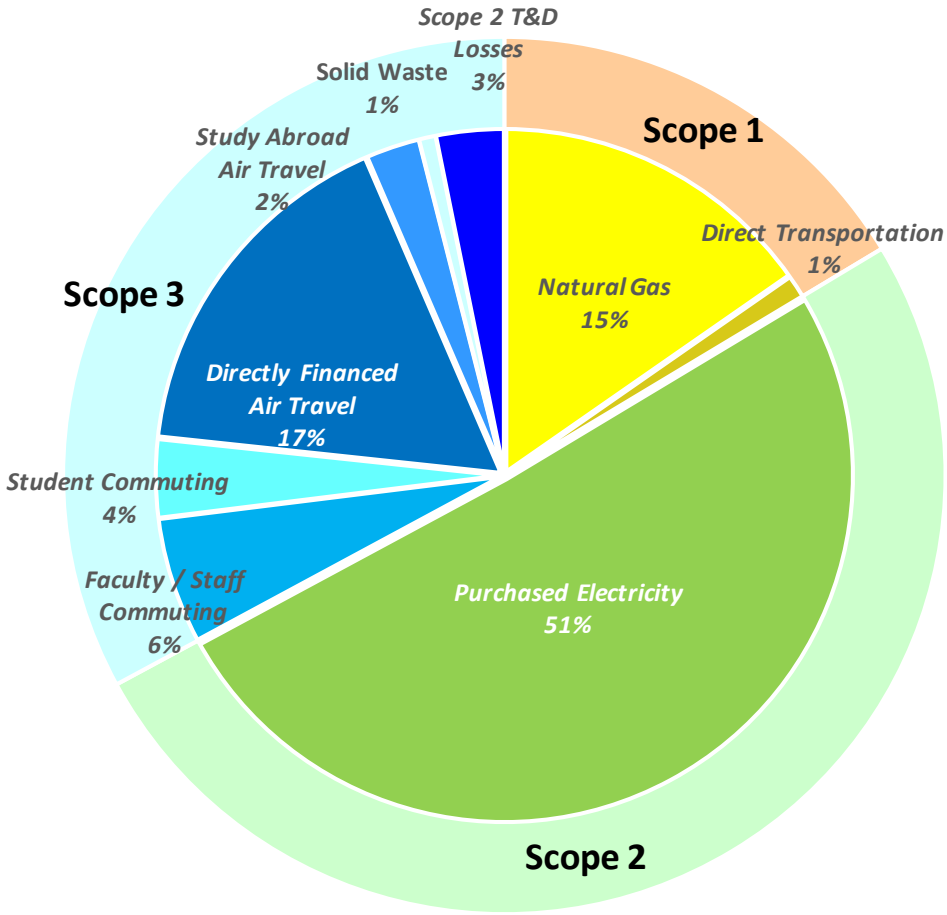
The University Planning Office is currently conducting a detailed study of building square footages on both the uptown and downtown campuses, which will result in an official list. Building area numbers in this inventory are based on the preliminary results of this study, and in some cases are different from the square footage.

Sale & Destruction of Refrigerants

The refrigerant R-11 is a chlorofluorocarbon, which, in the 1987 Montreal Protocol, participating countries agreed to phase out of production due to their devastating impacts on the ozone layer. R-11 is also a harmful greenhouse gas and contributes to heat being trapped in earth's atmosphere. Table 2 shows the Global Warming Potential of common refrigerants used at Tulane over the last three years, of which R-11 has the greatest climate impact. Production of R-11 was ended in the US in 1996. When Tulane applied for its first LEED Green Building certification in 2010, the university pledged to remove CFCs from the systems that cool campus buildings. In 2015, Tulane University removed its last CFC-using chillers and sold 3757 pounds of R-11 refrigerant to EOS Climate for $22,542. EOS Climate is a company that pays for the destruction of refrigerants by selling the carbon credits—the avoided impact on climate change.

Conclusion & Next Steps

Figure 3: Proportion of Emissions by Scope & Category



Overall, Tulane's GHG emissions increased in 2015 as compared to the most recent 4 years of data with Scope 1 & 2 emissions increasing 5% since 2014. Additionally, as student population and building area increase, emissions levels have generally decreased over time. In order to meet the Climate Action Plan's 2020 reduction goal, however, direct actions should be taken in the areas pinpointed for emissions reduction.

Electricity use was the most significant contributor to GHG emissions during the 2015 calendar year. Overall, electricity increased by 8,046,970 kWh from 2014 to 2015, increasing emissions by 16,812 eCO2. This could in part be attributed to the addition of several buildings that were built or reopened during the 2014-2015 period or were not previously accounted for in the 2014 inventory. These buildings include including Yulman Stadium, Greenbaum Residence Hall, the Center for Jewish Life (912 Broadway), The Stephen Paul Jacobs House (8317 Freret St.), the Tulane City Center (1725 Baronne St), and the new Biloxi campus, and the reopening of the vivarium on the downtown campus.

In order to meet our Climate Action Plan emissions reductions goal, consumption of energy by buildings must be reduced. The first step in effective reduction is analysis of campus buildings and benchmarking of energy use. Tulane launched in January 2016, an online building dashboard, showing electric, natural gas, steam, and chilled water use at campus facilities on a long and short term basis. The Climate Action Plan identifies building energy conservation measures that could substantially reduce energy use in the near-term with a relatively short payback. Implemented together, these energy conservation measures would have a Capital cost of $6 million and Annual Operations & Maintenance costs of $.9 million, reducing annual energy costs by $1.6 million and annual GHG emissions by 14,132 MTCO2e.

Methodology

Calculator

Since 2006, the Tulane University Office of Sustainability has used the Clean Air-Cool Planet (CA-CP) Campus Carbon Calculator, the tool officially recommended by the ACUPCC, to calculate Tulane's GHG emissions. The calculator was originally developed by the former non-profit Clean Air - Cool Planet and the Sustainability Institute at UNH in 2001 and released to the public in 2004. It can be found on the University of New Hampshire's Sustainability Institute Website. In 2015, version 8.0 of the calculator was released, with updated emissions factors reflecting the most recent data from EPA, E-GRID, and other public data sources. Version 8.0 was used for this inventory. Because the calculator is continuously updated according to the latest research, annual totals can vary based on the version of the calculator used. For consistency, the historic numbers presented in this report are based on the annual totals that were calculated at the time that each inventory was released. These totals are documented on secondnature.org.

Full information on data sources and methodology is provided in the Appendix of the 2006-2008 Inventory, with updates to this noted below.

Buildings

Electricity and Natural Gas

The majority of data was obtained through Tulane's utility bills or building managers. In a few cases, energy information was not available for certain buildings or timeframes. Table 2 lists these breaches in data and the methods used to account for them.

Table 2: Breaches in Data

Location	Utility	Method of Accounting for Missing Data
Aron Residence Hall	Electricity	Averaged electricity usage from 2011, 2012, and 2013 to get a figure for 2014 and 2015 due to lack of data
1555 Poydras Street	Electricity	Averaged electricity usage from 2011, 2012, and 2013 to get a figure for 2014 and 2015
1555 Poydras Street Servers	Electricity	We were missing data for June and July 2015. Averaged data for other 10 months and used for June and July
Houston, TX Campus	Electricity	Carried electricity usage from 2012 for both 2013,2014, and 2015 due to lack of data
A Studio in the Woods	Electricity	Several months of data were missing from energy bills. Used graphs on energy bill to estimate monthly totals
Center for Jewish Life	Electricity	Several months of data were missing from energy bills. Used graphs on energy bill to estimate monthly totals

Methodology

Steam/ Natural gas conversions to energy

On the downtown Health Sciences campus, Tulane has limited its purchasing of steam and chilled water from outside providers through to the installation of boilers and chillers within downtown buildings. Bills from EnWave were provided by Facilities Services accounting department. In order to convert these purchases to reflect total energy used, we used the following calculations, based on information provided from Energy Star and Entergy.

Steam (lbs) to mmBtu= multiply by 1.003342
Chilled water (tons) to mmBtu= multiply by .012

Propane

Only the Primate Center used propane during 2015. Monthly propane totals were provided by an employee of the primate center.

Refrigerants

The total amount of refrigerants used were provided by Facilities Services. As discussed in the Significant Changes section of this report, the total amount of refrigerants used was significantly lower than in previous years. Table 3 shows the Global Warming Potential of common refrigerants used at Tulane over the last three years, of which R-11 has the greatest climate impact. Although 3757 pounds of R-11 were sold by Tulane for destruction, this is not accounted for as a subtraction in this inventory, as Tulane received a payment for the carbon credits, allowing another entity to "count" these emissions reductions.

Table 3: Refrigerants Use

Refrigerants Used in 2013, 2014, and 2015 (lbs)				
Refrigerant	GWP (100-year values)	2013	2014	2015
HFC-134a	1,430	2,600	1170	655
HCFC-22	1,810	550		
R-11	4,680	600		
R-123	76		600	

Sources: IPCC 4th Assessment Report; LEED Reference Guide Version 4

Travel

The University's accounting department provided monetary data on business travel reimbursement, which was divided into the categories of domestic travel by car, domestic travel by air, and foreign travel by air. Total miles traveled were then calculated according to conversion factors from Airlines for America and mileage rates from the U.S. General Services Administration. Dollars spent were translated to miles traveled and then to gallons of fuel.

Methodology

Commute data

In 2014, a university-wide commuting survey was completed by the Office of Sustainability, documenting the commuting habits of students, faculty, and staff. The 2014 percentages for each mode of transportation were used to calculate totals for this year, based on the current population numbers at Tulane.

Waste

Due to departmental reorganization and changes in waste haulers, waste and recycling totals were not available for the 2015 year. Total numbers from 2014 were used in calculations.

Study Abroad

Study abroad mileage was calculated based on the number of students who studied abroad in each country in 2015. Total miles traveled were then calculated based on information from the U.S. Department of Transportation's website based on the assumptions that students left from the closest international airport hub, Houston George Bush Intercontinental Airport and arrived in the largest international airport within each destination country.

Fleet

Vehicle Fleet data was provided by Retif Oil & Fuel, which supplies Tulane fleets with fuel by charging all purchases to fuel cards at each department. Retif provided a list of fuel card purchases from each department at Tulane. Although there are fuel tanks located on campus, these require the use of a fuel card, which are recorded with Retif's list of purchases.

Tulane University's 2015 Greenhouse Gas Emissions Inventory was conducted and written by Liz Pfafflin of the Tulane University Office of Sustainability.