Tulane University

2019 Greenhouse Gas Inventory Report

Introduction

The 2019 Greenhouse Gas (GHG) Inventory Report documents Tulane University's GHG emissions for the calendar year 2019. With both current and historical data dating to 2007, the Greenhouse Gas Inventory provides data by which to assess the university's progress toward reducing GHG emissions.

In 2008, Scott Cowen, former university president, signed the Presidents' Climate Leadership Commitments, pledging the university to assess GHG emissions annually and to develop a Climate Action Plan. In 2015, Mike Fitts, president of the university, approved the 2014 Tulane Climate Action Plan, which lays out near-term, mid-term, and long-term portfolios of action to reduce GHG emissions to 15% below the 2007 emissions, the university's baseline year, by the year 2020; 30% by 2025; and carbon neutrality by 2050.

The university community—leadership, students, faculty, and staff—help optimize university operations for low-carbon impact by creating a culture of energy conservation, making campus facilities more efficient and effective, and ultimately by transitioning to clean fuels.

Boundaries

The annual GHG inventory calculates emissions from university facilities and transportation operated by Tulane University between the dates January 1-December 31, 2019. This includes the uptown campus, the downtown health sciences campus, the Tulane River and Coastal Center, and the Tulane National Primate Research Center. Tulane Medical Center and Tulane Lakeside Hospital, operated and largely owned by Hospital Corporation of America, are not included in this inventory.

Greenhouse Gas Emissions Scopes

In greenhouse gas emissions tracking and reporting, emissions are reported in a framework of "Scopes" differentiated by the direct or indirect role of the institution in the release of emissions.

Scope 1 emissions are emissions directly released by the institution. Scope 1 emissions include the on-campus combustion of fossil fuels (principally natural gas, gasoline, diesel, and propane) as well as the direct release of greenhouse gases, such as hydrofluorocarbons (HFCs) used as refrigerants.

Scope 2 emissions are indirectly released by the university through the purchase of fossil fuel-generated utilities. In 2019 Tulane purchased electricity from Entergy and steam and chilled water from Enwave in downtown New Orleans. Purchased electricity is the university's largest area of energy consumption and greenhouse gas emissions.

Scope 3 emissions comprise all other indirectly released emissions. Scope 3 emissions is a vast category that can include activities as divergent as commuter emissions, business travel, and the embodied emissions of purchased materials, food and other products.

The Office of Sustainability tracks Scope 1 and Scope 2 emissions. While Scope 3 emissions are significant, methods of consistently and accurately tracking Scope 3 emissions at the scale of the university need further development.

2019 Greenhouse Gas Emissions

The university reduced its total greenhouse gas emissions during the 2019 calendar year. Scope 1 and Scope 2 emissions together amount to 80,544 Metric Tons Carbon Dioxide Equivalent (MTCO2e). This is a reduction of 14.2% from the previous year (2018) and 4.2% below emissions produced in 2007, our baseline year. Graph 1 presents the university's total Scope 1 and Scope 2 emissions by year since 2007, with the reduction goal for 2020 also shown. Tables 1 and 2 present the numbers for the emissions represented in Graph 1.

Graph 1: Tulane University Annual Greenhouse Gas Emissions

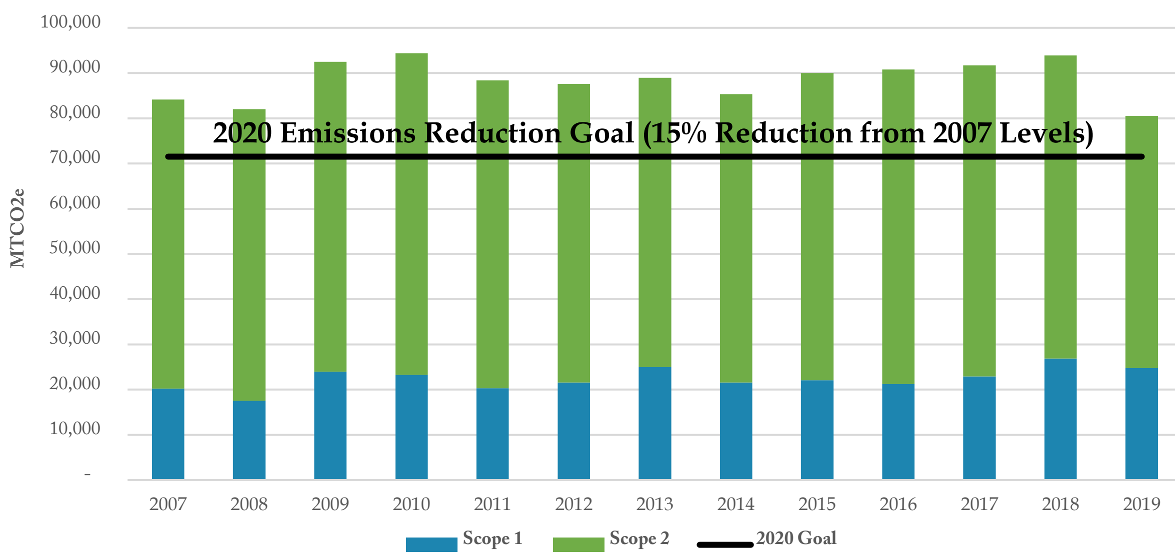


Table 1: Tulane University Annual Greenhouse Gas Emissions

Tulane University Annual GHG Emissions (MTeCO2)				
	Total Scope 1	Total Scope 2	Scope 1&2	2020 Goal
2007	20,244	63,900	84,144	
2008	17,566	64,427	81,993	
2009	23,953	68,571	92,524	
2010	23,275	71,088	94,363	
2011	20,303	68,097	88,399	
2012	21,546	66,095	87,641	
2013	24,971	64,004	88,975	
2014	21,559	63,776	85,335	
2015	22,089	67,900	89,989	
2016	21,248	69,526	90,774	
2017	22,938	68,765	91,703	
2018	26,850	67,046	93,895	
2019	**24,737**	**55,807**	**80,544**	71,522

Table 2: Greenhouse Gas Emissions Reduction Progress

Greenhouse Gas Emissions Reduction Progress	
Change 2018 to 2019	-14.22%
Change from 2007 Annual Emissions	-4.28%
Annual Emissions Reduction Remaining to Meet 2020 Goal (15% below 2007 Annual Emissions)	9,022 MTCO2e

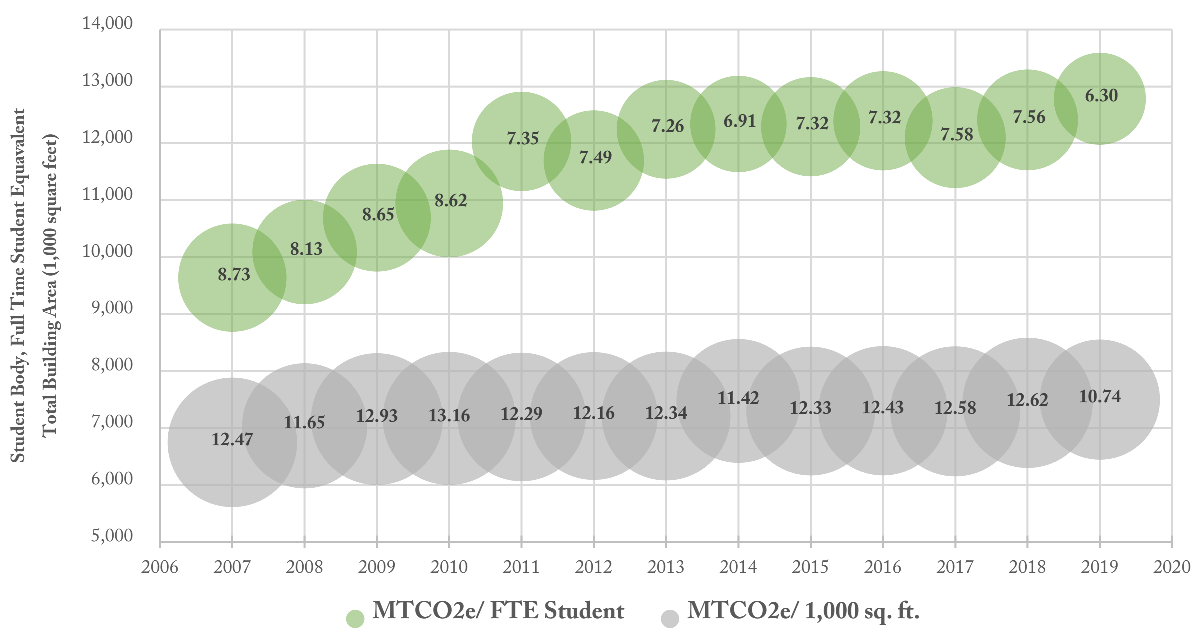
Emissions Intensity

The university's Climate Action Plan lays out goals for reducing the university's total emissions. To understand emissions trends in the context of the university's growth, it is helpful to review the university's emissions relative to the university student population and total building area. 2019 data not only indicate that the university reduced its total emissions but that it also reduced its emissions intensity, a gauge of emissions released in service to the work of the institution.

The upward trend of circles in the chart below shows that both student population and space have grown, with students (green) increasing more dramatically than building area (grey) over time. The circle size indicates emissions intensity, the annual GHG emissions per full-time student equivalent and 1,000 square feet of building area. The number of full-time equivalent students (FTE students) is calculated from the sum of full-time student enrollment plus ½ of the part-time student enrollment.

The table of data from which this graph 2 has been developed can be found in Appendix B.

Graph 2: Tulane University Annual Greenhouse Gas Emissions Intensity



Discussion

For the calendar year 2019, the greenhouse gas emissions that result from university activities decreased substantially. In this section we review factors that influence these emissions.

Scope 1 and 2 emissions result from fossil-fuel based energy use and the direct release of greenhouse gases, such as hydrofluorocarbons (HFCs) used as refrigerants. Table 3 presents these tallies by fuel and refrigerant for 2017, 2018, and 2019.

Table 3: Energy & Refrigerant Use Comparison

Energy & Refrigerant Use Comparison				
Source	**Units**	**2017**	**2018**	**2019**
Electricity, Grid	**kWh**	147,236,649	142,884,447	142,375,463
Natural Gas	**MMBTU**	384,869	478,366	443,341
Purchased Steam	**MMBTU**	2,485	1,098	933
Purchased Chilled Water	**MMBTU**	5,737	5,281	4,235
Propane	**Gallons**	339	0	121
Gasoline	**Gallons**	84,383	88,681	83,913
Diesel	**Gallons**	30,369	39,960	34,419
Refrigerants HFC-134a	**lbs purchased**	1750	290	125

Use of all types of energy decreased in 2019, with a notable decrease in use of natural gas.

Electricity is purchased from our local utility, Entergy New Orleans. Electricity is used in university buildings to power pumps and fans; artificial lighting; elevators, electronics and office equipment, refrigerators, and other equipment. A major use of electricity is by chillers, a kind of large equipment that produces chilled water used to cool buildings.

Natural gas is used by boilers to create steam that provides heat and hot water to buildings. The Combined Heat and Power (CHP) unit in the Uptown campus central plant (also known as Co-generation) burns natural gas create steam, which is run through a turbine to generate electricity and then is used to provide heat to buildings. The total amount of natural gas and electricity purchased by the university can vary greatly from year to year, depending the level of reliance on CHP unit.

On the downtown campus, the university purchases steam and chilled water from district utilities as a backup source of heating and cooling.

Gasoline and diesel are principally used by university vehicles including shuttles and transportation for affiliates, athletics, and police. Our grounds department also uses these fuels to power some of their equipment. Diesel is also used in emergency generators and as a back-up fuel for the CHP unit in the central plant.

The GHG profile includes HFCs refrigerants, potent greenhouse gases. This inventory records the refrigerants purchased for chillers, but careful measures are taken so that they are not released.

Projects Affecting Energy Use

Facilities Services completed a number of energy reduction projects in 2018, reducing 2019 energy use. These six projects upgrade existing technologies for an estimated combined annual energy use reduction of 548 MTCO2e. Many of these projects earned rebates from Energy Smart, the local energy efficiency program developed by the New Orleans City Council and administered by Entergy New Orleans. They had a very short payback, which is the time it takes for the energy cost savings to pay back the cost of the project. For example, a project with a payback of .5 years recoups the cost of the project in 6 months, but it then continues to save energy and energy costs for years into the future. Table 4 lists the energy conservation measures completed in 2018 that would impact energy use during 2019. See Appendix A for a list of emissions reduction projects completed since 2014 with associated emissions and cost reduction.

Table 4: Emissions Reduction Projects impacting 2019 Inventory

				Actual or Projected			Annual Savings		
PROJECT ▲	STATUS	INSTALL COMPLETE DATE	TYPE	COST	ANNUAL ROI	PAYBACK (YRS)	EMISSIONS (MTCO2E)	ENERGY (MMBTU)	WATER (GAL)
Off-Site ECM - Book Storage Lighting Retrofit 2018	Completed	12/31/2018	Lighting	$ 8,119	84.5%	1.1	52	327	0
Transportation - Entergy EIF Shuttles 2018	Proposed	08/01/2018	Transportation	$ 16,950	-10.0%	0.0	0	0	0
Uptown ECM - Boggs HVAC (3) VFD Replacements 2018	Completed	05/24/2018	Building Heating, Ventilation, Air Conditioning (HVAC)	$ 20,907	173.7%	0.5	259	1,638	0
Uptown ECM - Dorms Lighting Occupancy Sensors 2018	Completed	11/27/2018	Lighting	$ 999	31.4%	2.4	3	18	0
Uptown ECM - HTML 24-hour Lighting Retrofit 2018	Completed	12/31/2018	Lighting	$ 8,505	237.7%	0.4	142	899	0
Uptown ECM - Jones Hall Retrofit of Stack Area 24-hour Lights 2018	Completed	12/31/2018	Lighting	$ 102	8,797.0%	0.0	61	383	0
Uptown ECM - Site Lighting Upgrades Phase 2 (Rear Campus) 2019	Completed	12/01/2018	Lighting	$ 147,219	-6.9%	31.8	31	198	0

New construction, renovations and demolition of buildings also influence energy use. Bruff Commons, the former undergraduate dining hall, closed in August 2019 and was demolished early in 2020. The Commons, a newly constructed 91,153 square foot building housing a dining hall and office space, opened in August 2019. Taking into account reductions and additions to Tulane campuses between 2018 and 2019, the total university building area increased by 57,000 square feet (0.7%), necessarily increasing university energy use

Climate & Weather

Variations in climate and weather impact university energy use principally through demand for heating and cooling over the course of the year. During 2019, air temperature in the New Orleans area was milder than the previous year, requiring less heating and less cooling in campus buildings. Measured in heating and cooling degree days, 2019 had fewer heating degree days and fewer cooling degree days than the two previous years.

Degree days indicate how long (days) and how much (degrees F) the outdoor air temperature required either heating or cooling. Based on outside air temperature, one factor that drives heating and cooling loads, degree days offer an incomplete but useful view of the climatic demand on fossil fuel consumption in buildings. Degree days are also one way to compare the impact of climate on buildings in different climate conditions.

In most university buildings, heating systems are steam-based, fueled by natural gas. Cooling systems on the Uptown campus are largely driven centralized chilled water, fueled by electricity drawn from the utility grid. Other cooling systems are conventional electric air-conditioning units. Fewer heating degree days would require less natural gas to heat buildings and fewer cooling degree days would require less electricity to cool buildings.

Table 5: Climate & Weather

Heating and Cooling Degree Days					
New Orleans Lakefront Airport (KNEW)	**2007**	**…**	**2017**	**2018**	**2019**
Heating Degree Days (HDD)[1]	1,116		1247	1,247	1,182
Cooling Degree Days (CDD)[2]	3,433		3538	3,538	3,455

[1] Fahrenheit-based heating degree days with a base temperature of 65 F

[2] Fahrenheit-based cooling degree days with a base temperature of 65 F

Data Source: BizEE Weather Data for Energy Saving, www.degreedays.net.

Emissions Factors

Emissions factors (also known as Emissions Coefficients) are the amount of a greenhouse gas or gases released by using one unit of a fuel or energy source. The emissions factors for burning different types of fossil fuels, such as coal or gasoline, are determined by the chemical properties of the fuel and stay the same no matter where or when the fuel is burned.

The emissions factor for purchased electricity depends on the types of fuel and energy sources used to generate the electricity, so electricity emissions factors will be different in different places and at different times. This GHG Inventory uses an eGrid regional electricity emissions factor calculated by the U.S. Environmental Protection Agency for the SERC Mississippi Valley, an area that roughly corresponds with the service area of our utility, Entergy. This is the location-based approach to Scope 2 emissions factors.

Scope 2 emissions, the emissions of purchased utilities, are in a special category, because the user and the provider share responsibility for these emissions. The user controls the amount of electricity consumed, while the provider (usually a utility) controls the types of energy sources used to generate the electricity. If fossil fuels are used, the electricity emissions factor will be high. If renewables or nuclear energy is used, the electricity emissions factor will be zero. Tulane's Scope 2 emissions are reduced when we use less electricity, and when electricity in our region is generated from cleaner sources.

You can learn more about electricity emissions factors and the eGrid regions at the U.S. EPA's Power Profiler website.

Table 6: Scope 2 Emissions Factors

Scope 2 Emissions Factors			
Tulane GHG Report	**2017**	**2018**	**2019**
eGrid Region	SRMV: SERC Mississippi Valley, 2007 and beyond		
Emission Factors Version	AR4	AR4	AR5
Emission Factors Database	eGRID2014	eGRID2016	eGrid2018[1]
CO2e	1027.1 lb/MWh	842.2 lb/MWh	858.4 lb/MWh

[1] United States Environmental Protection Agency. 2020. "Emissions & Generation Resource Integrated Database (eGRID) eGRID2018." Released 1/28/2020; Revised 3/9/2020. Accessed April 3, 2020. https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Tulane Climate Action Week 2019

Tulane Climate Action Week 2019, held in March 2019, was a week-long, university-wide discussion of climate change and actions that will prevent its most devastating effects. Keynote speaker Professor Kevin J. O'Brien of Pacific Lutheran University spoke on "The Violence and the Hope of Climate Change: Idealist Activism, Pragmatic Engineering, and a Just Future." Events included speakers, film screenings, a poetry reading, a career panel, a campus & community climate action organization fair, and an environmental research poster session. The event was largely organized by Tulane students, with sponsors that included the Phyllis M. Taylor Center for Social Innovation and Design Thinking, Office of Sustainability, the ByWater Institute, Environmental Studies Program, USG Sustainability Committee, Earth & Environmental Sciences, the Office of Academic Affairs and Provost, Net Impact, the New Orleans Center for the Gulf South, A Studio in the Woods and New Orleans Video Access Center.

Looking Forward

The 2019 greenhouse gas inventory indicates the university is making strides toward its emissions reduction goals. Given the complexity of the drivers of greenhouse gas emissions and the complexity of university operations, reducing emissions on the order of magnitude to meet and exceed Climate Action Plan goals reaches into all aspects of university operations, from capital projects and planning, through building operation, to campus energy conservation culture.

In 2020, two large projects recommended by the 2014 Tulane University Climate Action Plan will begin operation and emissions savings. The Central Plant Chiller Optimization project improves the efficiency of the system that delivers chilled water to campus buildings by installing software that uses a mathematical framework to continuously dispatch cooling generation systems in an economically optimal way. This project became operational in early 2020 and will have an estimated reduction of 1,000 MTCO2e/year.

In summer 2020 an Absorption chiller, which will run on excess steam from the CHP system, will be installed. This system will increase the efficiency of the CHP, and it will also provide cooling to buildings in emergency situations. The 2014 Climate Action Plan estimated that using the CHP with a steam-driven chiller would reduce emissions 4,796 MTCO2e/year, while a 2016 DOE study estimated GHG savings could reach 16,000 CO2e tons/year.

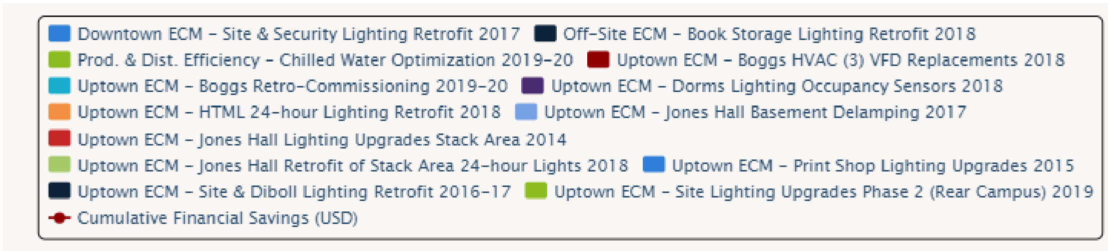
In 2020, savings will be also be realized from a pilot Retro-commissioning project in the Lindy Boggs building, also known a "building tune-up." A study was conducted Nov.-Dec. 2019 with focus on air handling units, chilled water pumping, heating hot water pumping system, and lighting. It generated a list of maintenance needs and recommended Energy Conservation Measures to implement. With rebates, this project cost the university $7,425 and will save $35,030 in energy costs each year. It can serve as a model for a larger program that is systematically applied to all large university buildings.

While we are beginning to have success reducing our emissions, the next few years will be a critical time for even greater climate action. The response to COVID-19 has altered university operations and energy use in the short term, and in ways that may affect long-term emissions. At the same time, the scientists of the Intergovernmental Panel on Climate Change (IPCC) have recently revised estimates of the emissions reductions needed to avoid catastrophic impacts from climate change, finding that global CO2 emissions will need to be reduced by 50% by 2030, and reach net zero by 2050. We must maintain a focus on the short, medium, and long-term challenges of climate change, even as we respond to the current global pandemic.

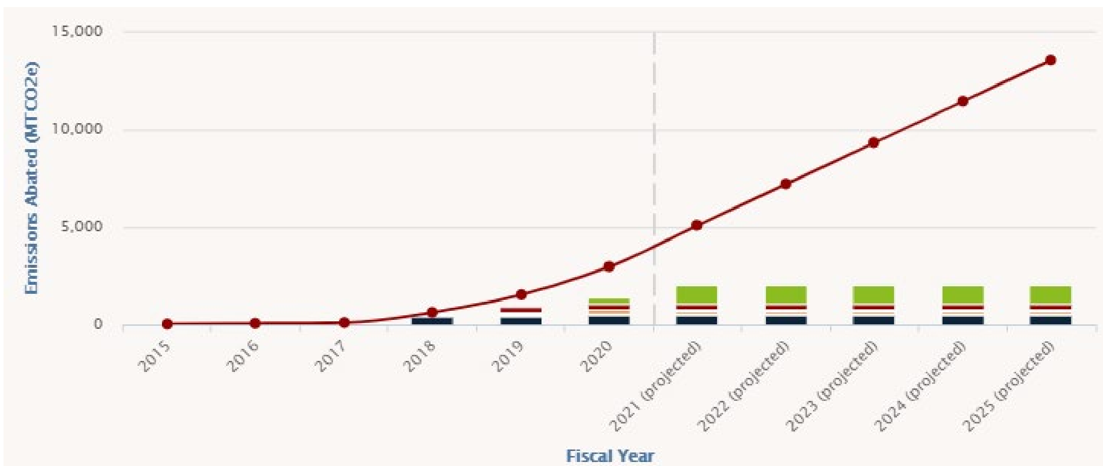
Tulane University's Greenhouse Gas Emissions Inventory was conducted & written by Jordan Stewart, Assistant Director, Office of Sustainability, with assistance from Nicholas Pellegrini, Student Intern, and Liz Davey, Director.

Appendix A

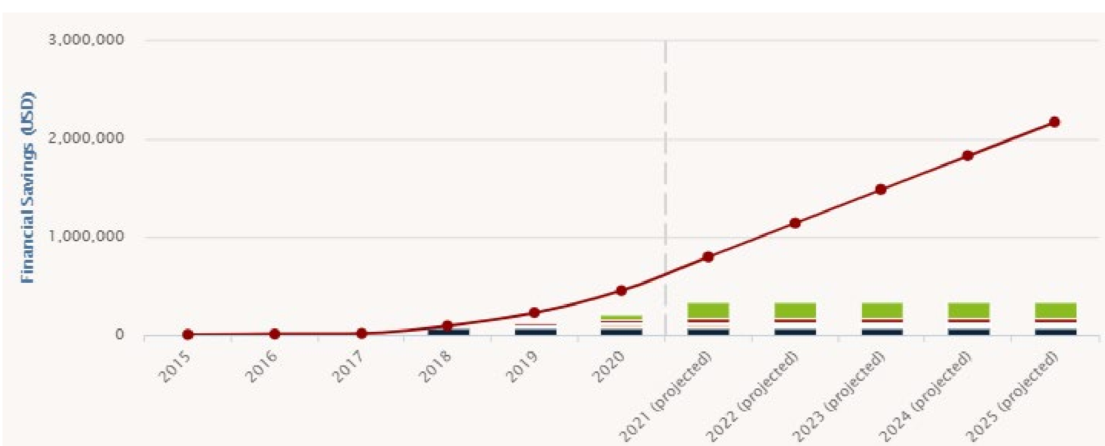
Energy Conservation Projects Completed Since 2014



Graph 3: GHG Emissions Abated & Projected since 2014 by Energy Conservation Projects



Graph 4: Financial Savings & Projected since 2014 by Energy Conservation Project



Appendix B

Normalized Emissions & Emissions Intensity

The university's Climate Action Plan lays out goals for reducing the university's total emissions. To understand emissions trends in the context of growth, it is helpful to review the university's emissions relative to the university student population and total building area. Table 3 presents emissions intensity per student and per 1,000 square foot of building area. The number of full-time equivalent students (FTE students) is calculated from the sum of full-time student enrollment plus ½ of the part-time student enrollment.

Table 7: Normalized Emissions

Normalized Emissions					
	MTCO2e (Scopes 1&2)	FTE Students (Full Time Equivalent)	MTCO2e/ FTE Student	Building Area (1,000 sq. ft.)	MTCO2e/ 1,000 sq. ft.
2007	84,144	9,641	8.73	6,747	12.47
2008	81,993	10,091	8.13	7,038	11.65
2009	92,524	10,695	8.65	7,156	12.93
2010	94,363	10,945	8.62	7,168	13.16
2011	88,399	12,034	7.35	7,193	12.29
2012	87,641	11,699	7.49	7,210	12.16
2013	88,975	12,248	7.26	7,210	12.34
2014	85,335	12,341	6.91	7,475	11.42
2015	89,989	12,293	7.32	7,297	12.33
2016	90,774	12,397	7.32	7,303	12.43
2017	91,703	12,101	7.58	7,292	12.58
2018	93,895	12,413	7.56	7,441	12.62
2019	**80,544**	**12,784**	**6.30**	**7,498**	**10.74**