Tulane University

2020

Greenhouse Gas Inventory Report

Office of Sustainability
CAMPUS SERVICES
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Introduction

The 2020 Greenhouse Gas (GHG) Inventory measures Tulane's annual emissions in Metric Tons Carbon Dioxide Equivalent (MTCO2e). An annual GHG inventory is part of our participation in the Presidents' Climate Leadership Commitments, a national network of universities committed to addressing climate change. Even with the disruptions and changes to operations made in response to the COVID-19 pandemic, the 2020 GHG inventory results can elucidate the progress towards carbon neutrality.

2020 greenhouse gas emissions **decreased** from 2019 levels. In 2020, 78,337 Metric Tons Carbon Dioxide Equivalent (MTCO2e) were released either directly by university activities or indirectly by purchased energy, a 2.74% reduction in emissions from 2019.

2020 marks the first year with a specific reduction goal set out by the 2014 Tulane Climate Action Plan, which set targets of a 15% reduction in emissions below that of 2007 by 2020, 30% emission reduction by 2025, and carbon neutrality by 2050. The 2020 emissions were 6.9% below 2007 emissions.

Tulane's greenhouse gas emissions have decreased more substantially when the student population and university building space of baseline year 2007 are considered. Emissions per student decreased 31% between 2007 and 2020. Emissions per square foot building space decreased 18% between 2007 and 2020. These Emissions Intensity figures help place the university's GHG emissions trends in the context of the university's growth since 2007.

The university continuously implements strategies to promote and facilitate a reduction in emissions and mitigation of the university's environmental impact. The GHG inventory helps the Tulane community better understand the factors that contribute to greenhouse gas impact and track the university's progress toward these goals.

Boundaries

The GHG inventory measures emissions from university operated facilities, rental property, and transportation between January 1 and December 31st, 2020. Areas covered in the report include the uptown campus, the downtown health science campus, and the Tulane National Primate Research Center. Past inventories included the Houston campus, which closed in July 2020. The Tulane Medical Center and Tulane Lakeside Hospital, owned and operated by Hospital Corporation of America, are not included.

Greenhouse Gas Emissions Scopes

Scope 1 emissions are those directly produced by the institution through the use of fossil fuels in equipment (such as natural gas combustion) and vehicles (gasoline or diesel), and fugitive emissions (such releases of hydrofluorocarbons [HFCs] used as refrigerants).

Scope 2 emissions are indirectly released, resulting from purchased electricity, steam and chilled water. Tulane's Scope 2 emissions mostly result from the generation of the electricity we purchase from our utility, Entergy.

Scope 3 emissions are those resulting from sources not owned or operated directly by the university. Emissions from contractors, employee traveling and commuting, waste disposal and treatment, food sourcing and transport, and the manufacture of materials used on campus all fall under Scope 3 emissions.

Currently, the Office of Sustainability measures Scope 1 and Scope 2 emissions for the annual GHG inventory. Scope 3 emissions are not included due to the difficult and imprecise nature of measuring and calculating them. Scope 3 emissions are important in understanding the university's climate impact. Further research is needed to determine optimal ways to include these emissions. Students interested in pursuing projects related to quantifying Scope 3 emissions are encouraged to contact the Office of Sustainability.

2020 Greenhouse Gas Emissions

2020 greenhouse gas emissions **decreased** from 2019 levels. In 2020, Tulane released 78,337 Metric Tons Carbon Dioxide Equivalent (MTCO2e) compared to 80,544 MTCO2e in 2019, exhibiting a 2.74% reduction in total emissions from 2019.

Graph 1 shows the 2020 data in comparison to past years, dating back to 2007. Annual Scope 1 data is indicated by the blue bars, and Scope 2 emissions by green bars. The black line represents the target emissions reduction for 2020, 15% of 2007's MTCO2e. These data are presented numerically in Table 1. A breakdown of university energy and refrigerant use in recent years is shown in Table 3.

Graph 1: Tulane University Annual Greenhouse Gas Emissions

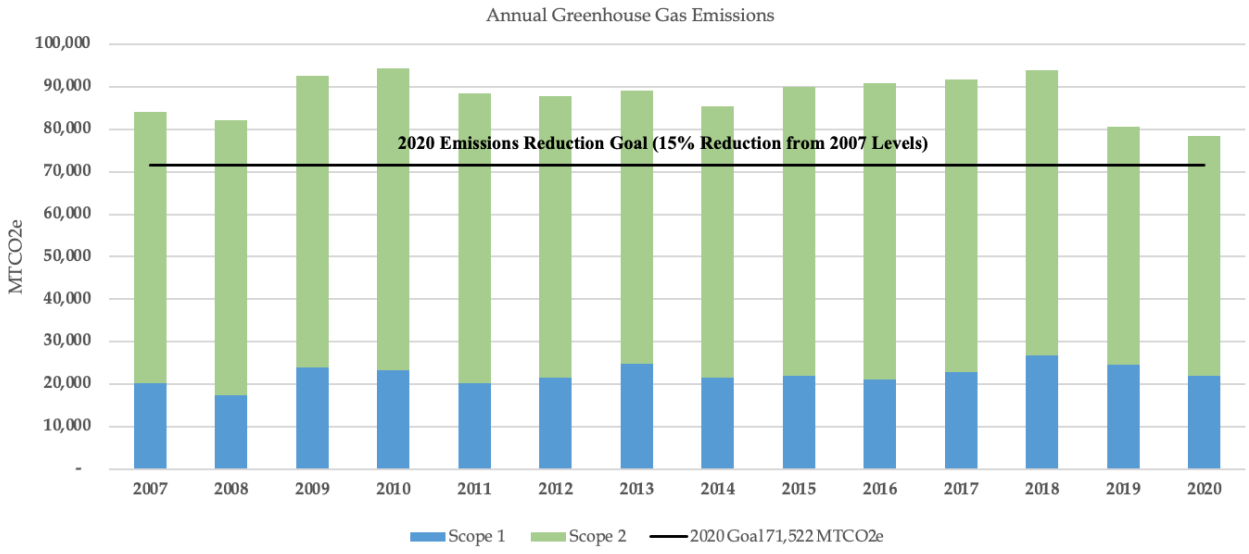


Table 1: Tulane University Annual Greenhouse Gas Emissions

GHG Emissions (MTeCO2)				
	Total Scope 1	Total Scope 2	Scope 1&2	Emissions in Excess of 2020 Goal (71,522)
2007	20,244	63,900	84,144	12,622
2008	17,566	64,427	81,993	10,471
2009	23,953	68,571	92,524	21,002
2010	23,275	71,088	94,363	22,841
2011	20,303	68,097	88,399	16,877
2012	21,546	66,095	87,641	16,119
2013	24,971	64,004	88,975	17,453
2014	21,559	63,776	85,335	13,813
2015	22,089	67,900	89,989	18,467
2016	21,248	69,526	90,774	19,252
2017	22,938	68,765	91,703	20,181
2018	26850	67,046	93,895	22,373
2019	24,737	55,807	80,544	9,022
2020	21,949	56,388	78,337	6,815

Table 2: Greenhouse Gas Emissions Reduction Progress

Greenhouse Gas Emissions Reduction Progress	
Change 2019 to 2020	2.74% Reduction
Change from 2007 Emissions	6.90% Reduction
Annual Emissions Reduction Remaining to Meet 2020 Goal	6,815 MTCO2e

Emissions Intensity

To better understand current emission reductions, we have scaled them to different measures of university growth. Below annual emissions are shown per university student and 1,000 square feet of total Tulane building area. Student numbers are calculated using the Full Time Equivalent (FTE), the number of full-time students plus half the amount of part time students. Both the number of FTE students and building area have steadily increased since 2007, indicated by the upward trend of the green and grey circles.

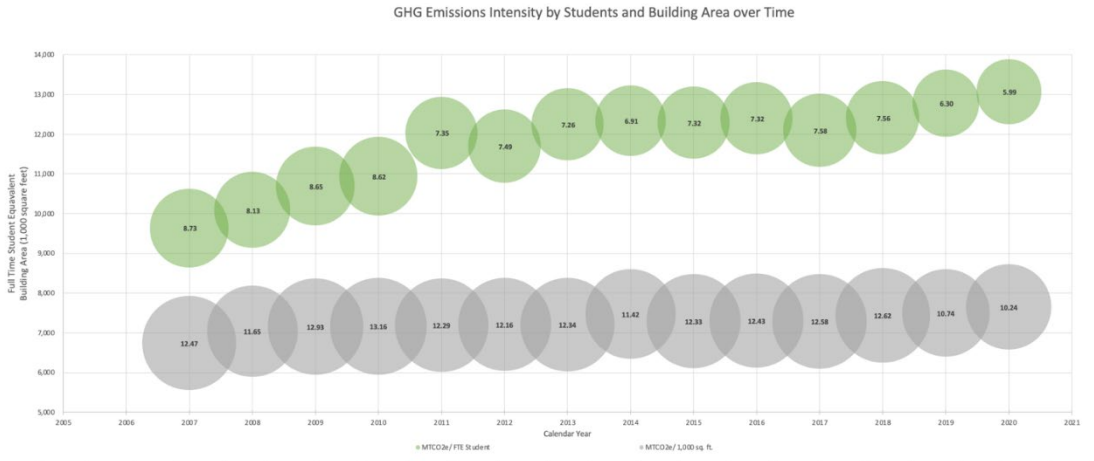
Emissions per student have decreased substantially between 2007 and 2020, from 8.73 MTCO2e/FTE student in 2007 to 6.3 in 2019 and 5.99 in 2020, indicated by the smaller sizes of the green circle. Emissions per student have decreased 31% since 2007. It is important to note that many students in 2020 had a different relationship to campus infrastructure and energy use, as more lived off-campus and some were completely online.

Emissions per square foot building area have also decreased, from 12.47 MTCO2e/sq. ft. building area in 2007 to 10.74 in 2019 and 10.24 in 2020. It is important to note that the building square footage sum for 2020 does not include the temporary buildings constructed to meet COVID-19 operational needs, which began operating August 1st, 2020. Their energy use is included in emissions calculations; however, the total building area does not include their square footage due to the brief operating time of 4 months in 2020.

These numbers help place the university's GHG emissions trends in the context of the university's growth since 2007. While the student body has grown by about 33% since 2007, and the building space operated by the university has grown by about 10% since 2007, GHG emissions have decreased. It should be noted that in 2007, the baseline year, the university was still heavily impacted by Hurricane Katrina.

See Appendix A for the numerical data represented in Graph 2.

Graph 2: Tulane University Annual Greenhouse Gas Emissions Intensity



GHG Emissions and Energy Use

Scope 1 and Scope 2 greenhouse gas emissions largely result from energy use but also include the direct release of greenhouse gasses. This section discusses energy use patterns in 2020 as well as energy conservation projects implemented to mitigate current and future consumption.

Weather and climate as well as the electricity emissions factor—the amount of GHG released per unit of purchased electricity—are also relevant to the emissions totals for 2020. However, neither changed significantly between 2019 and 2020. For further detail, see Appendix B for a discussion of how climate and weather influence energy consumption on campus and Appendix C for a discussion of the greenhouse gas emissions electricity emission factor used in this report.

Energy & Refrigerant Based Emissions

Consumption of most energy sources decreased in 2020 from 2019 with the exception of electricity purchased from the grid and steam purchased for downtown buildings. See Table 3 below.

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. Electricity is used by chillers in the power plants to provide chilled water for cooling in buildings.

Natural gas is used by boilers in the power plants to create steam that provides heat and hot water to buildings. The Combined Heat and Power (CHP) unit (also known as co-generation) in the uptown campus central plant burns natural gas to create steam, which is first run through a turbine to generate electricity and then is used to provide heat to buildings. In 2020, a chiller was installed in the uptown campus power plant that utilizes waste steam to provide chilled water for cooling in 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 uptown campus central plant.

The GHG profile includes HFC refrigerants, which are potent greenhouse gases. This inventory records the refrigerants purchased for chillers within each calendar year; careful measures are taken so that they are not released.

Table 3: Energy & Refrigerant Use

Scope	Source	Units	2017	2018	2019	2020
1	Natural Gas	MMBTU	384,869	478,366	443,341	392,797
1	Propane	Gallons	339	0	121	477
1	Gasoline	Gallons	84,383	88,681	83,913	70,670
1	Diesel	Gallons	30,369	39,960	34,419	24,111
1	Refrigerant HCFC-22	Lbs	NA	NA	NA	125
1	Refrigerant HFC-134a	Lbs	1750	290	125	NA
1	Refrigerant HFC-410a	Lbs	NA	NA	NA	144
2	Purchased Electricity, Grid	kWh	147,236,649	142,884,447	142,375,463	143,988,808
2	Purchased Steam	MMBTU	2,485	1,098	933	999
2	Purchased Chilled Water	MMBTU	5,737	5,281	4,235	3,533

Projects Affecting Energy Use

Facilities Services undertook five major energy reduction projects in 2020. These projects upgrade campus infrastructure and building technologies as they achieve GHG reduction. Table 4 lists the energy conservation measures conducted in 2020 that would impact energy use during 2020 and beyond. See Appendix E for a list of emissions reduction projects completed since 2014 with associated emissions and cost reduction.

These projects include a large project optimizing the operation of the system that distributes chilled water to uptown campus building. An absorption chiller was added in the uptown campus power plant in 2020 to improve the efficiency of the co-generation facility; it is fully operational for 2021. Building retro-commissioning and lighting improvements reduced energy use and earned monetary rebates from Energy Smart, the local energy efficiency program developed by the New Orleans City Council and administered by Entergy New Orleans. With rebates, these projects have short payback, which is the time it takes for

the energy cost savings to pay back the remaining 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.

A number of projects are currently in planning with expected completion dates in late 2021 or early 2022. These include further energy conservation projects, including large-scale lighting retrofits and significant upgrades at the Tulane National Primate Research Center. In early 2022, five diesel buses will be replaced with new electric buses in the university shuttle fleet. The university is also exploring options for greater emissions reductions through physical improvements and efficiencies, including options for developing a photovoltaic installation on the uptown campus.

Table 4: Emissions Reduction Projects

				Actual or Projected			Annual Savings		
PROJECT	STATUS ▲	INSTALL COMPLETE DATE	TYPE	COST	ANNUAL ROI	PAYBACK (YRS)	EMISSIONS ($MTCO_2E$)	ENERGY (MMBTU)	WATER (GAL)
Prod. & Dist. Efficiency - Chilled Water Optimization 2019-20	Completed	02/28/2020	Building Heating, Ventilation, Air Conditioning (HVAC)	$262,000	55.2%	1.5	1,008	6,366	0
Uptown ECM - Boggs Retro-Commissioning 2019-20	Completed	01/08/2020	Building Heating, Ventilation, Air Conditioning (HVAC)	$7,425	277.0%	0.3	85	1,768	0
Downtown ECM - Lighting Retrofit to 4 Parking Garages	Completed	12/30/2020	Lighting	$3,560	721.7%	0.1	176	1,111	0
Uptown ECM - Stern 24-Hour Lighting	Completed	12/31/2020	Lighting	$12,542	105.5%	0.9	98	618	0
Uptown - Absorption Chiller (Steam Driven Chiller)	In-Progress	11/02/2020	Central Power/Heating Plant	Installed in 2020 as a resiliency measure, the unit was brought into full operation in 2021. Estimates of GHG savings vary widely, from 6,000-17,000 MTCO2e/year.					

2019 Novel Coronavirus Pandemic

2020 marked a year of extreme change and difficult adjustments. On March 16th, 2020, due to the emerging COVID-19 pandemic, Tulane switched to an all-online course load. Regular operations ceased for remainder of the year. Tulane returned to campus in the fall of 2020 with a hybrid education model, requiring many energy intensive measures which continued into the spring of 2021. As we transition to the post-COVID operations, it is important to continue to take strides to reduce energy use and achieve our greenhouse gas reduction goals, especially considering the role of climate change in global health threats.

COVID-19 Changes in Operation Reflected in GHG Report

- Spring and summer closure reduced campus population.
- Building HVAC schedule of heating and cooling unchanged in Spring 2020 despite university closure.
- Building ventilation increased to combat COVID-19 transmission, increasing energy usage.
- Deployment of 13 temporary structures **totaling to 76,100 square feet, with operation beginning** August 1st, 2020, increased building energy usage.
- Gasoline and diesel consumption changed due to travel restrictions, new social distancing measures, and event cancellations.

COVID-19 Changes in Operation Not Reflected in GHG Report

- Use of Hyatt Regency Hotel in Downtown New Orleans for arrival center and student quarantine was not factored into building energy usage.
- Addition of off-campus residence, the Green Wave Residence Hall at the Hyatt Place Hotel, not factored into building energy usage.
- Pandemic-related transportation by outside vendors and TEMS not included in diesel and gas usage.
- More students enrolled in all online-courses and subsequent reduction in on-campus student population not reflected in emissions per student calculations.
- Due to demand on campus facilities staff and restricted on-campus events, the capacity to implement more energy reduction projects and energy awareness outreach was limited in 2020.

Future Thinking

by Sara Good-Chanmugam, Class of 2021

While we didn't meet the 2020 target emissions reduction, there are still important goals in place. To achieve a 30% emission reduction by 2025 and carbon neutrality by 2050, Tulane must take significant measures to reduce energy usage and use cleaner energy sources. In order to reach the 2025 goal, we must reduce emissions by 19,436.2 MTCO2e. Curtailing CO2 emissions over the next 5 years will require changes to all facets of campus operations. The Intergovernmental Panel on Climate Change, the IPCC, emphasizes the urgency of achieving immediate reductions if we are to limit global warming to 1.5 degrees Celsius.

To better understand Tulane's impact on the environment and create strategies for decreasing our carbon footprint, methods of measuring Scope 3 emissions should be developed. While Scope 3 was not accounted for this year, previous Tulane GHG reports have estimated emissions from travel, food sources, and waste. As Tulane makes important strides in food sourcing and transportation, these improvements should be accounted for in the GHG inventory. Scope 3 emissions can help measure progress and indicate future climate change mitigation strategies.

To incentivize mitigation strategies and meet future emissions goals, the cost of carbon emissions on the environment and society can be monetized to create a market for carbon. The amount of metric tons of CO2 equivalent over the target level can be translated into money spent on carbon mitigation efforts. Such activities include wetland restoration and solar power investments, which have significant impacts on the level of atmospheric carbon dioxide. Strategies like this can help Tulane support climate change mitigation goals, even if we are unable to reach the target emission reduction level for university operations that year.

Over the next few years as climate change intensifies, New Orleans will face more variable weather conditions and storm surges. These conditions and stresses on our city will only become more apparent as greenhouse gas emissions continue to rise. Mitigating the severe and life-threating effects of climate change is possible. We are in a crucial time where the changes implemented could either prevent or intensify worse case future scenarios. Tulane has the tools and resources to foster major improvements in energy usage and creation, serving as a template for other schools in Louisiana and the nation. In the post-COVID world, Tulane can now prioritize greenhouse gas reduction strategies and meet future emission goals.

Tulane University's 2020 Greenhouse Gas Inventory Report was prepared by the Office of Sustainability with data from colleagues across the university. Data collection was conducted by student interns Sam Hinerfeld and Sara Good-Chanmugam. The document was drafted by Sara Good-Chanmugam and edited by Liz Davey, Director, and Jordan Stewart, Assistant Director.

Appendix A

Emissions Intensity

Table of the adjusted numbers per students and square footage to facilitate better understanding of emission changes.

Table 7: Emissions Intensity

	MTCO2e (Scopes 1&2)	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	12.471
2008	81,993	10,091	8.13	7,038	11.650
2009	92,524	10,695	8.65	7,156	12.930
2010	94,363	10,945	8.62	7,168	13.164
2011	88,399	12,034	7.35	7,193	12.290
2012	87,641	11,699	7.49	7,210	12.155
2013	88,975	12,248	7.26	7,210	12.340
2014	85,335	12,341	6.91	7,475	11.416
2015	89,989	12,293	7.32	7,297	12.332
2016	90,774	12,397	7.32	7,303	12.430
2017	91,703	12,101	7.58	7,292	12.576
2018	93,895	12,413	7.56	7,441	12.619
2019	80,544	12,784	6.30	7,498	10.742
2020	78,337	13,071	5.99	7,651	10.239

Appendix B

Climate & Weather

Variable climate and weather patterns change energy use and greenhouse gas emissions. The impact is partially quantified through heating degree days (HDD) and cooling degree days (CDD). HDD and CDD are measures of the amount of heat and cooling, respectively, needed to maintain a constant building temperature of 65 degrees. The weather in 2020 was warmer than that of previous three years, indicated by a lower amount of heating degree days and a higher amount of cooling degree days. In response, more energy was used to cool buildings, but less on warming them.

At Tulane, heating systems are fueled by natural gas, which uses steam to generate heat, while cooling systems either rely on electricity used to chilled water in a centralized location or air-conditioning units powered by electricity.

While the impacts of hurricanes on energy use are difficult to determine, 2020's record breaking hurricane season, with 30 named storms, may have influenced GHG emissions. Five of these storms hit the Louisiana coast, and in response to some of the more severe ones, Tulane shifted to emergency operations, which has effects on energy use.

Table 5: Climate & Weather

KNEW New Orleans Lakefront Airport	2007		2017	2018	2019	2020
Heating Degree Days (HDD)	**1,116**		**1247**	**1,247**	**1,182**	**835**
Cooling Degree Days (CDD)	**3,433**		**3538**	**3,538**	**3,455**	**3,672**

[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.

Appendix C

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.

For more information on electricity emissions factors and the eGrid regions at the U.S, visit the 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

Appendix D

Emissions Abated & Projected Reductions

This graph tracks emissions abatement projects implemented since 2014 over time to convey the cumulative effects of a breadth of energy reduction efforts. This graph does not include the uptown campus absorption chiller, installed late in 2020 but brought into use in 2021.

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