

# sightlines

a **GORDIAN**® company

# Catholic University of America FY20 Sustainability Solutions

Molly McGillian and Ditee Hossain

- University of the Sciences in Philadelphia
- University of Toledo
- University of Vermont
- University of Washington
- University of West Florida
- University of Wisconsin - Madison
- Vanderbilt University
- Virginia Commonwealth University
- Wake Forest University
- Washburn University
- Washington State University
- Washington State University - Tri-Cities Campus
- Washington State University - Vancouver
- Washington University in St. Louis
- Wayne State University
- Wellesley College
- Wesleyan University
- West Chester University
- West Virginia Health Science Center
- West Virginia University
- Western Oregon University
- Westfield State University
- Widener University
- Williams College
- Worcester Polytechnic Institute
- Worcester State University



# Sightlines Solutions at Gordian



## FACILITIES BENCHMARKING & ANALYSIS

Take control of your facilities and make the case for change without the guesswork



## FACILITIES ASSESSMENT & PLANNING

Plan and execute capital investment plans that are inclusive, credible, flexible, affordable and sustainable



## SPACE UTILIZATION

Ensure your space is working up to its full potential



## SUSTAINABILITY SOLUTIONS

Measure, compare and improve environmental stewardship

# Sustainability Solutions Agenda

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Summary of Emissions Profile

Scope 1 Emissions Overview

Scope 2 Emissions Overview

Scope 3 Emissions Overview

Conclusion

# Peer Institutions Used For Benchmarking

*Emissions calculated using a market-based method*

Institution	Location	Climate Zone
The Catholic University of America	Washington, DC	3
American University	Washington, DC	3
Millersville University	Millersville, PA	5
Rider University	Lawrenceville, NJ	4
Towson University	Towson, MD	4
Swarthmore College	Swarthmore, PA	4
Virginia Commonwealth University	Richmond, VA	4
Union College	Schenectady, NY	5



**Peer Group Based On**  
**Size**  
**Technical Complexity**  
**Climate Zone**

# Two Ways to Normalize Emissions for Comparison

## GHG Emissions per 1,000 GSF EUI Adjusted



Stresses intensity of operations.

$$\frac{\text{Gross GHG Emissions}}{\text{EUI Adjusted GSF}} \times 1,000$$

## GHG Emissions per Weighted Campus User




Stresses efficient use of space.


$$\frac{\text{Gross GHG Emissions}}{\text{Weighted Campus User}}$$


# Components of Emissions Profile


**Scope 1:**  
From sources owned or controlled by CUA

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On-Campus Stationary 

Vehicle Fleet 

Refrigerants 

Fertilizer 

**Scope 2:**  
From the generation of electricity purchased by CUA


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Purchased Electricity

**Scope 3:**  
From sources not directly controlled by CUA

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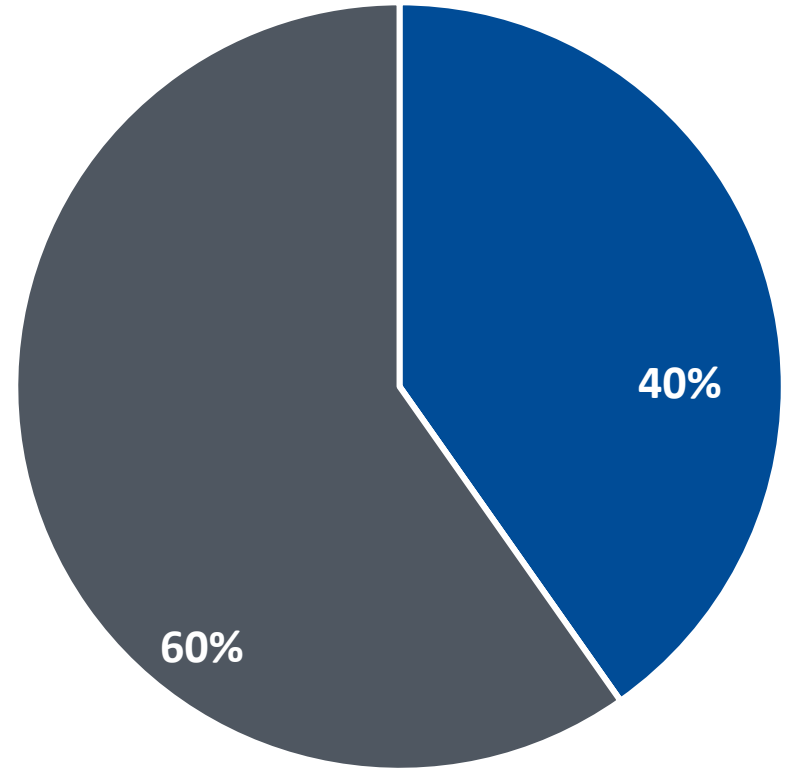
Directly Financed and Study Abroad Travel 

Waste and Wastewater 

Student, Faculty, and Staff Commuting 

Paper Purchasing  
Transmission and Distribution Losses

CUA FY20 Emissions by Scope

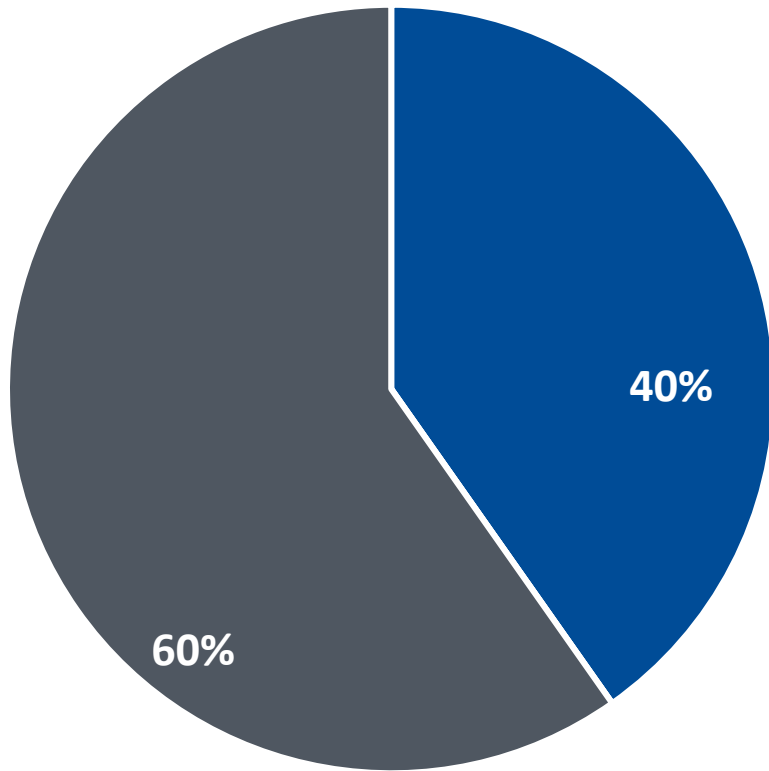


■ Scope 1    ■ Scope 2    ■ Scope 3

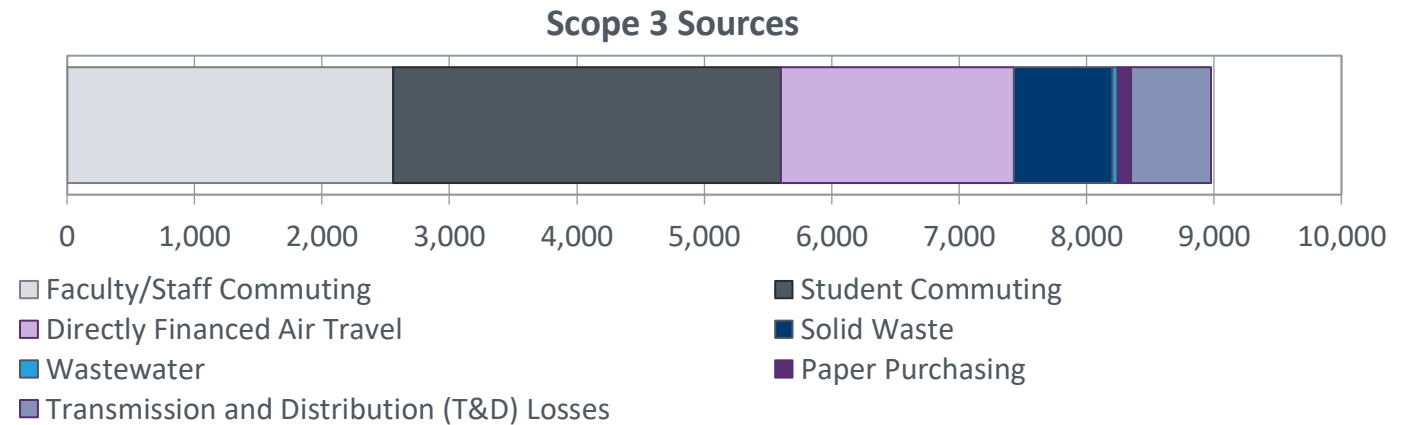
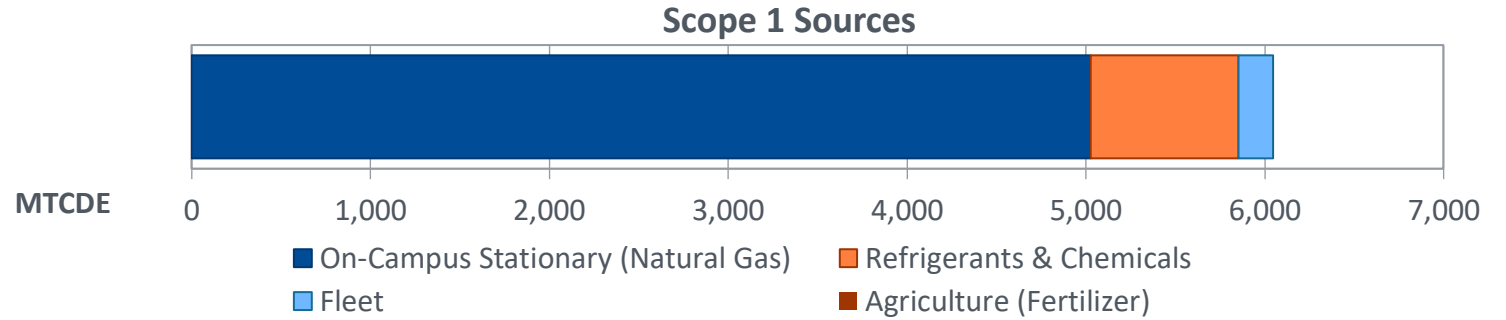
# Distribution of Emissions by Source

Emissions driven by natural gas and travel

## CUA FY20 Emissions by Scope



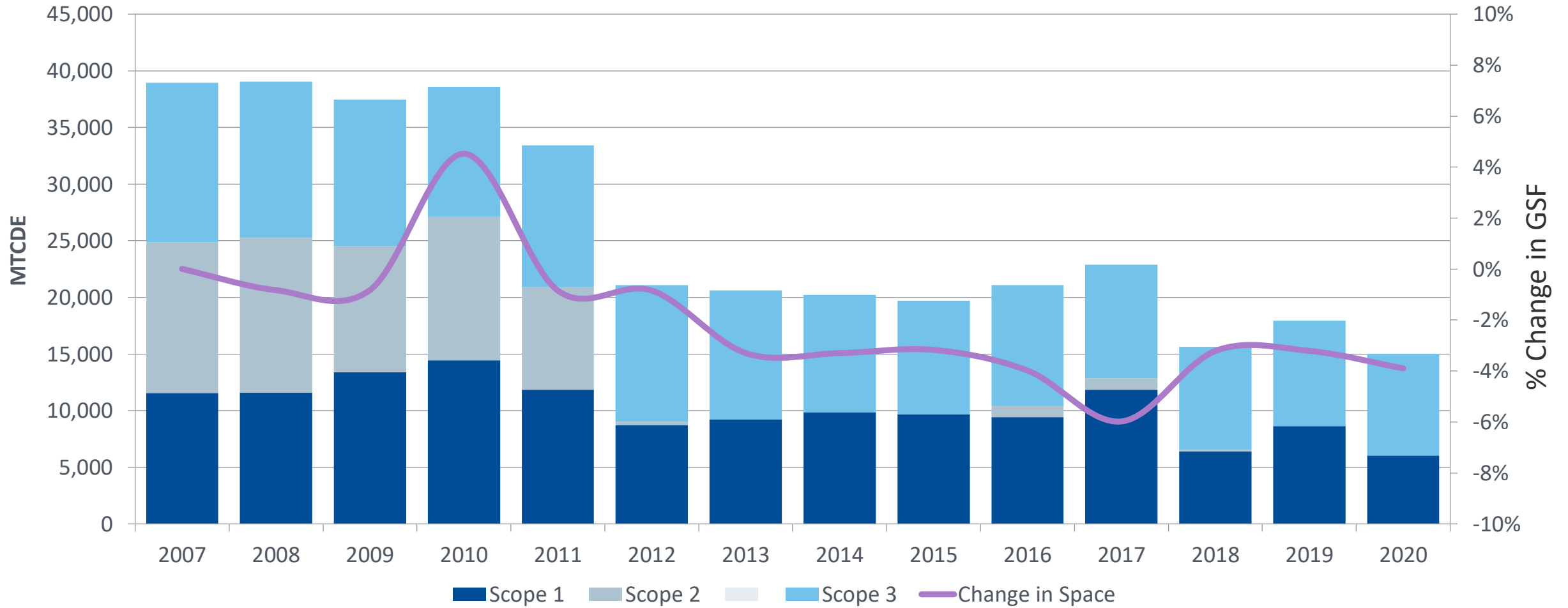
■ Scope 1    ■ Scope 2    ■ Scope 3





# Summary of Emissions Over Time

### Total Emissions vs. Space Growth

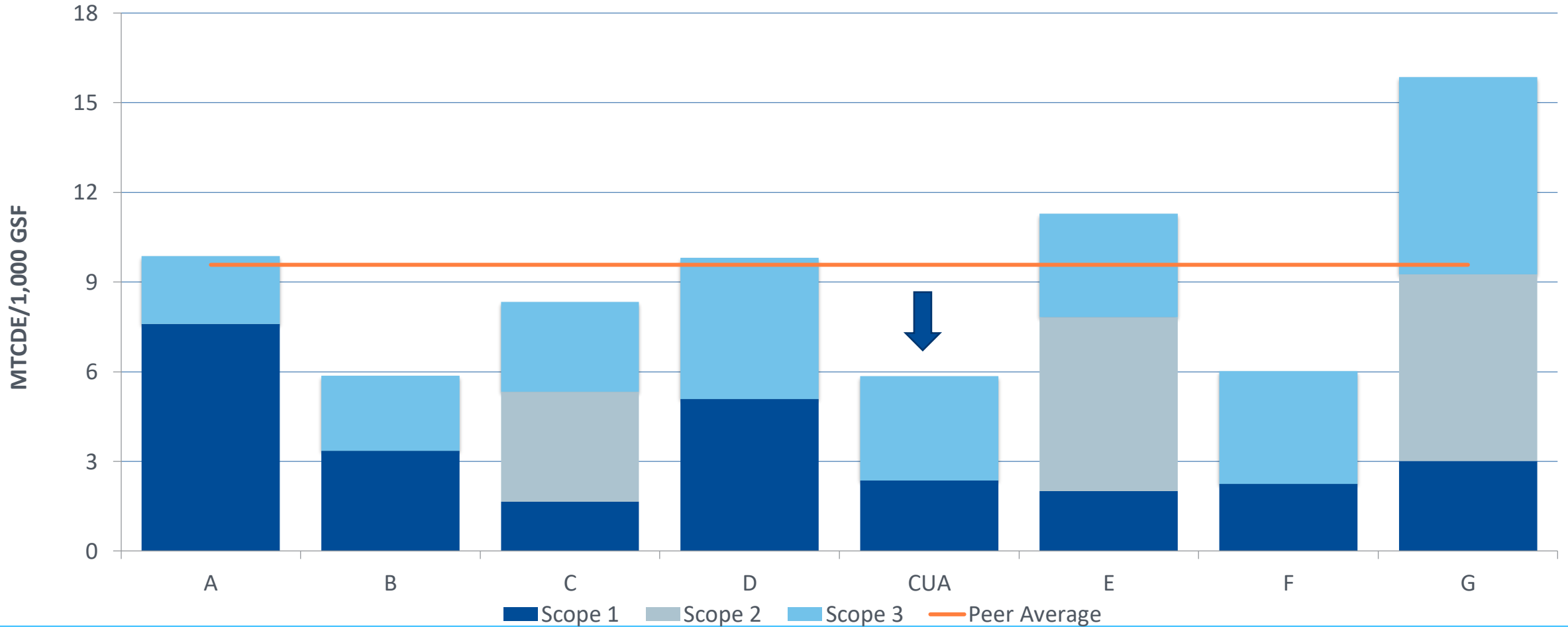




# Normalized Emission Compared to Peers

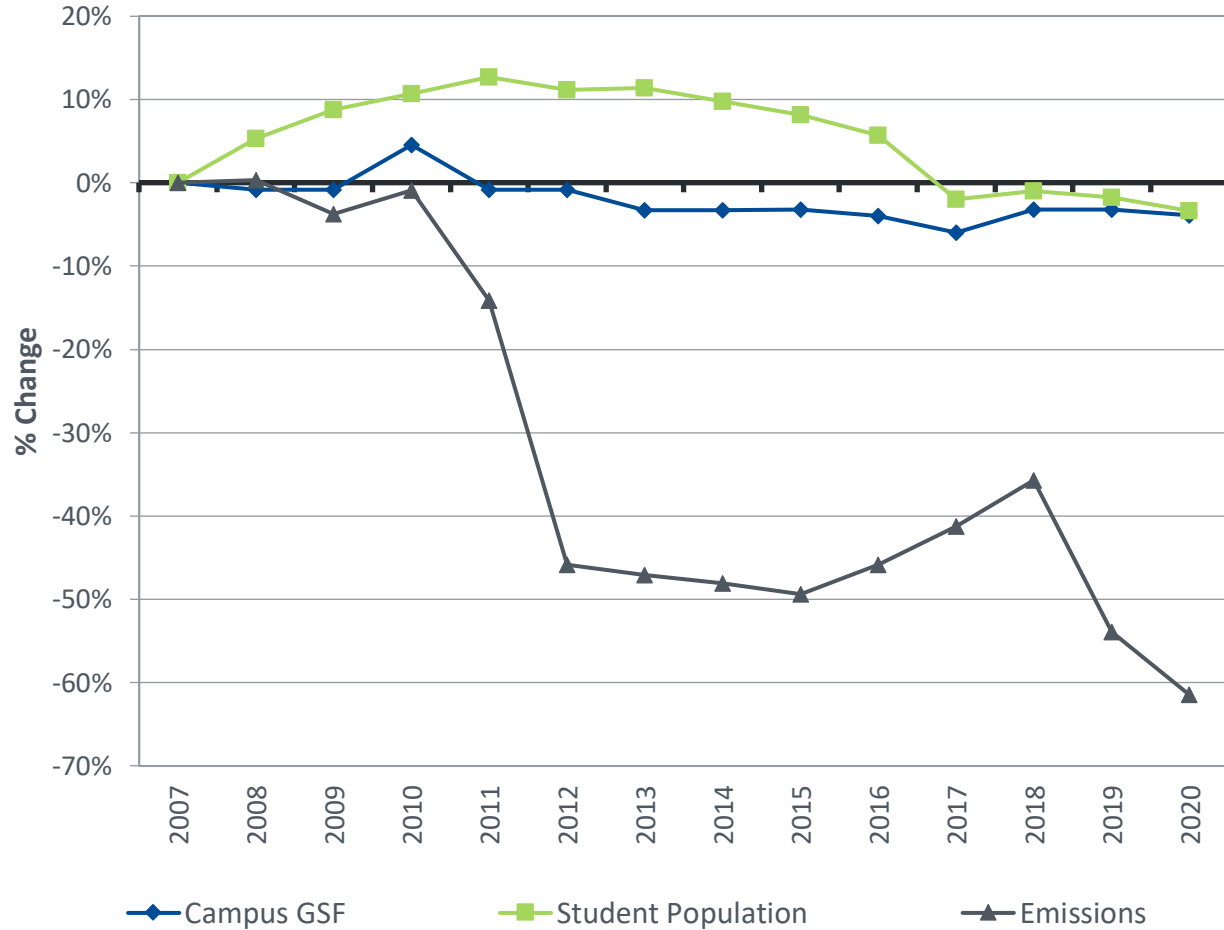
*CUA's produces less emissions per GSF than peer average*

## Normalized Emission

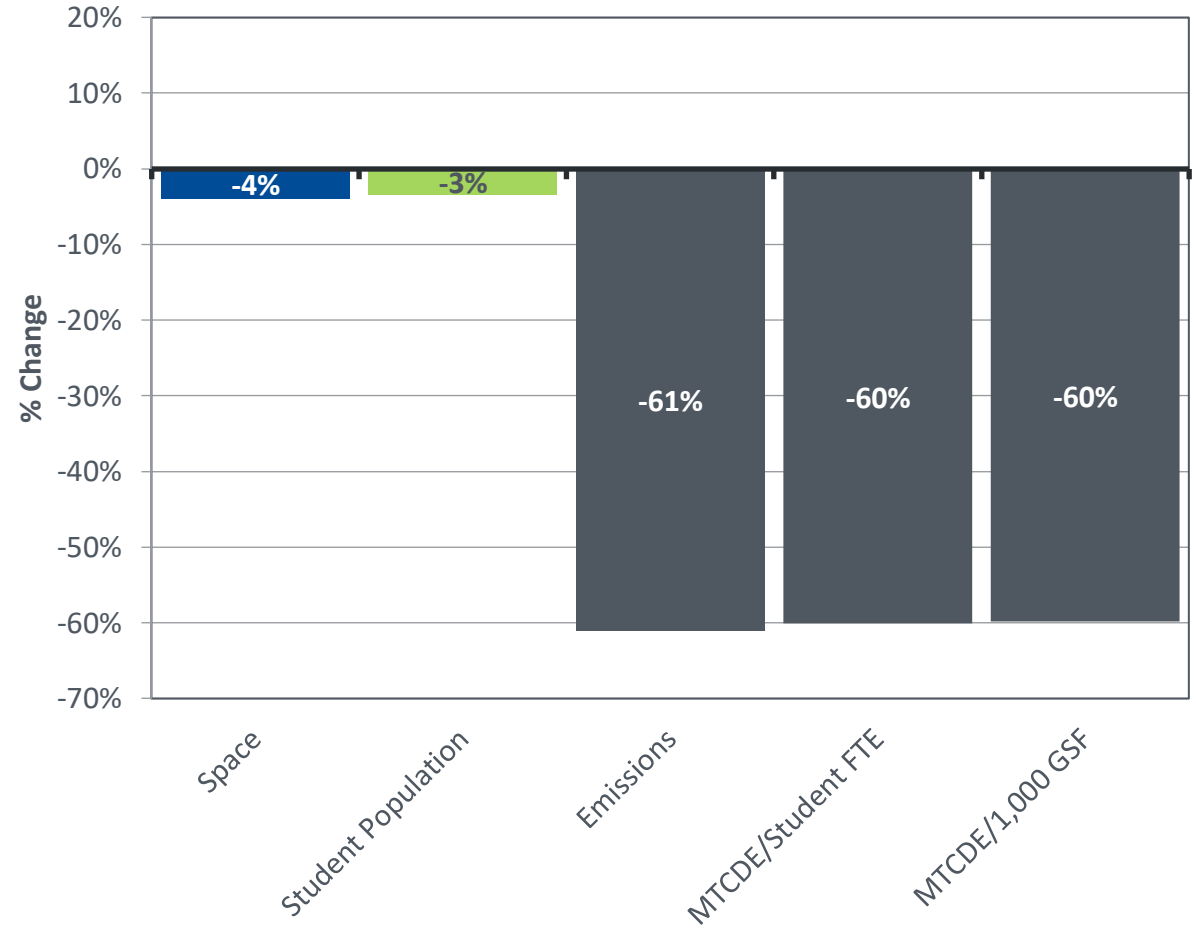


# Emission Compared to Space and Student Change

Change in Emissions vs. Change in Campus Size and Student Population Indexed to FY2007



Change in Space, Population, and Emissions Indexed to FY2007

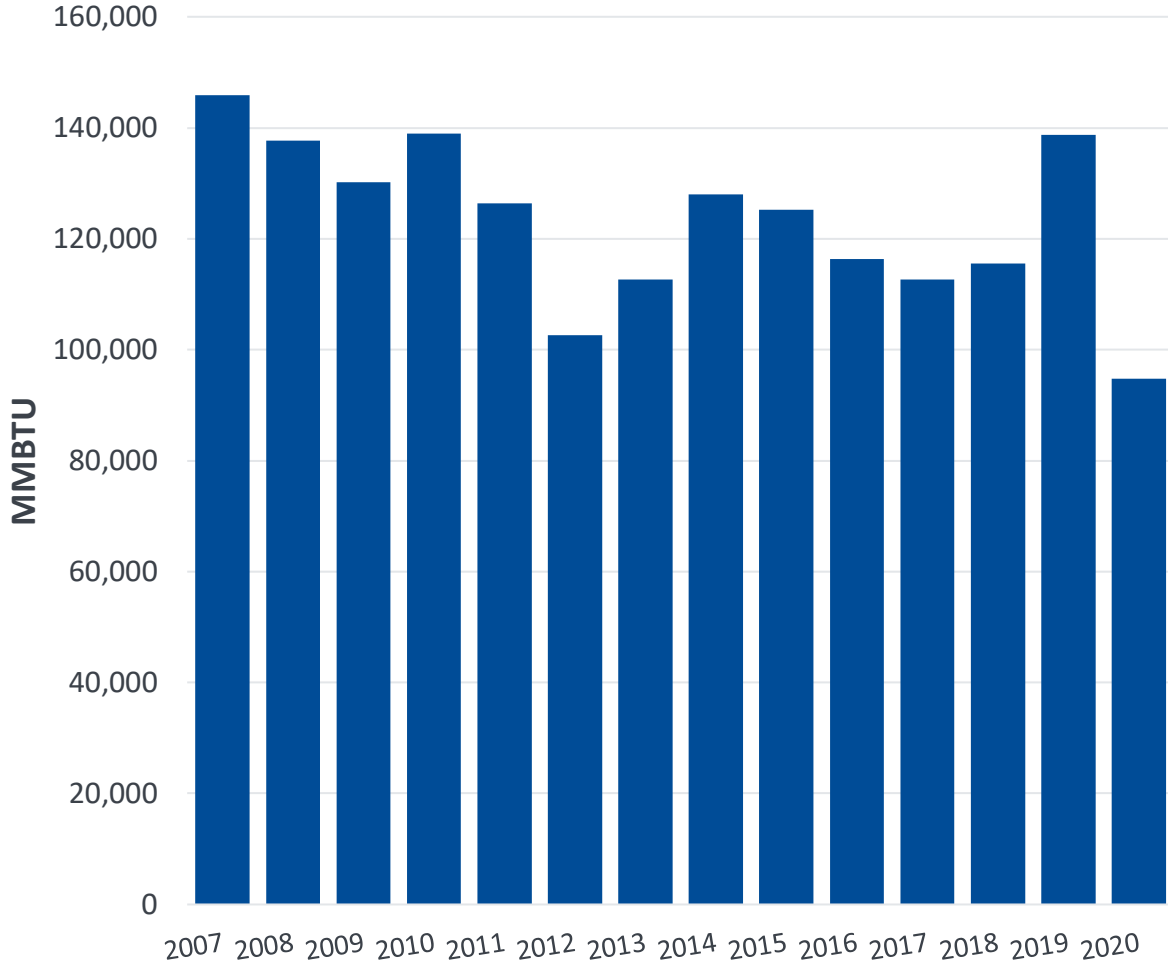


# Scope 1

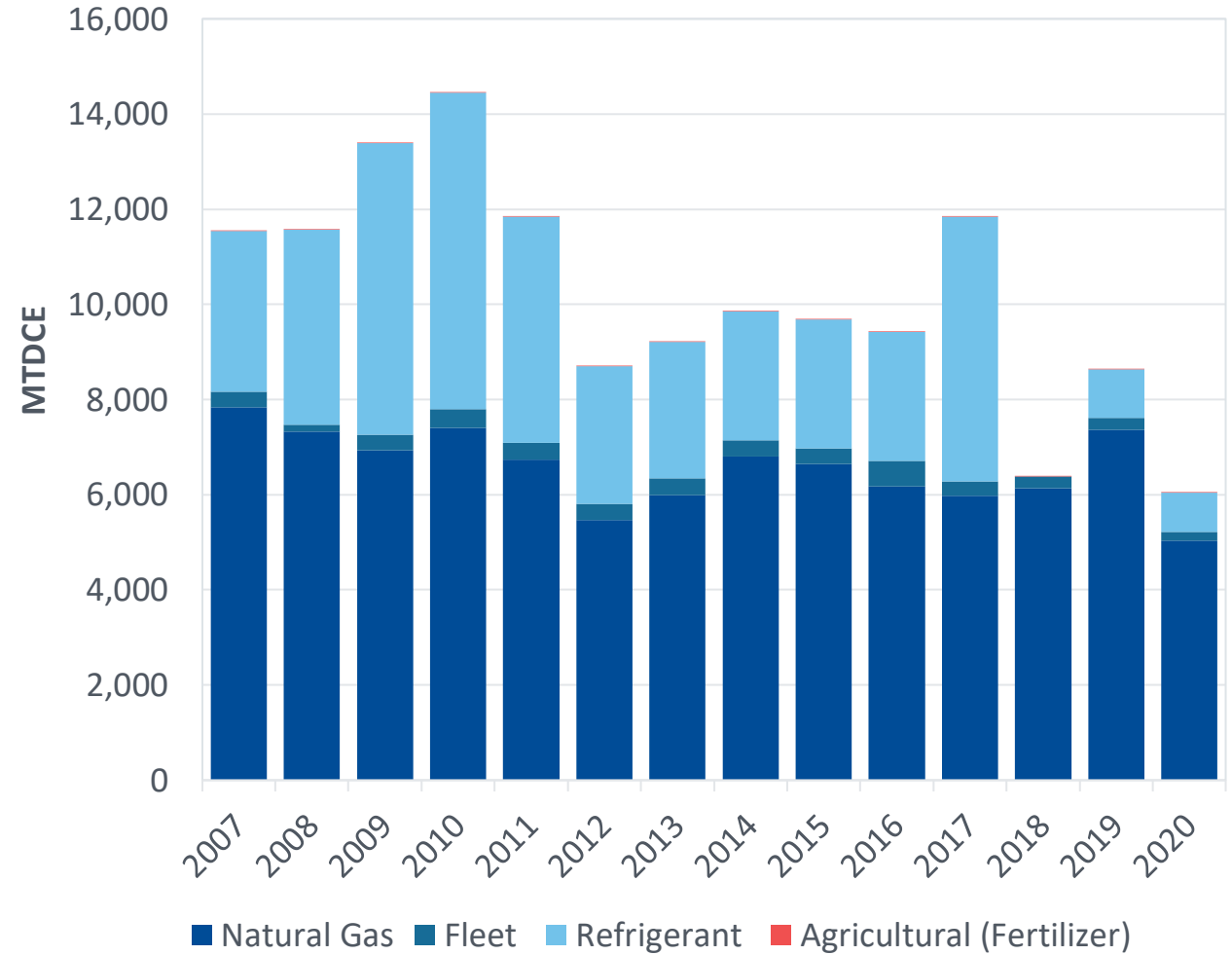


# Natural Gas Makes up Majority of Scope 1 Emissions

### Total Natural Gas Consumption



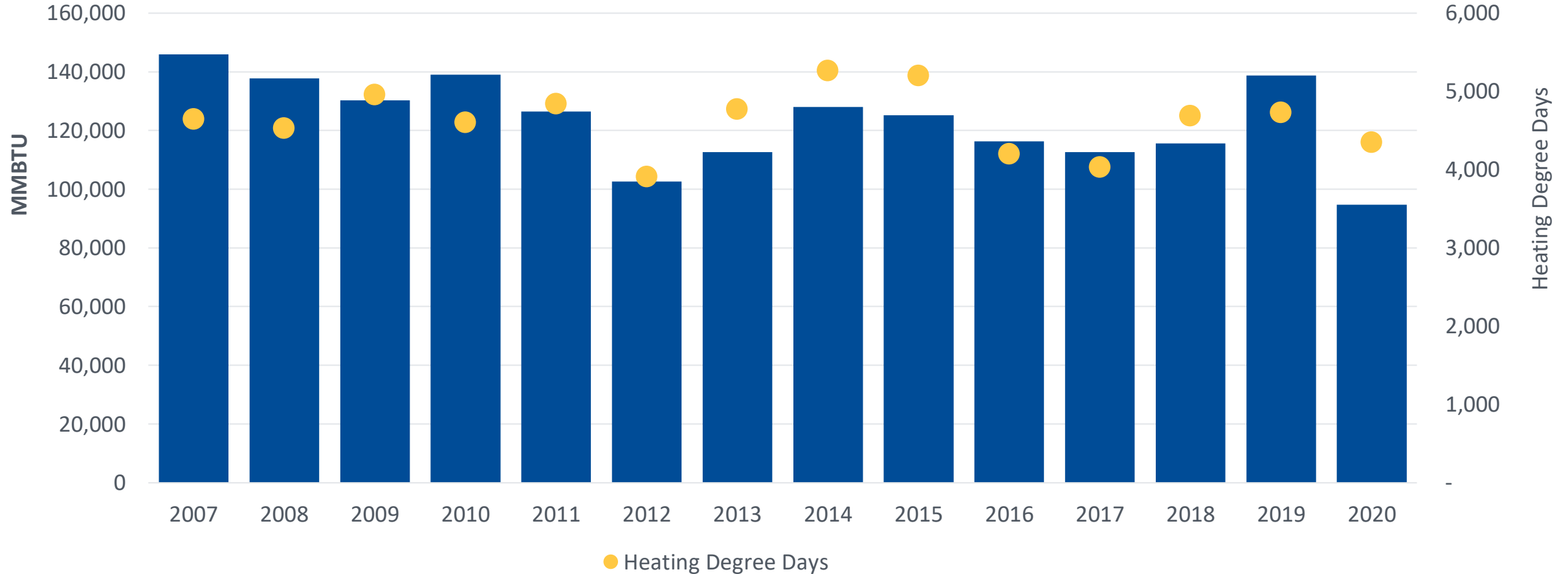
### Scope 1 Emissions



# Consumption Compared to Heating Degree Days

*Covid-19 and recent infrastructure projects decrease FY20's consumption*

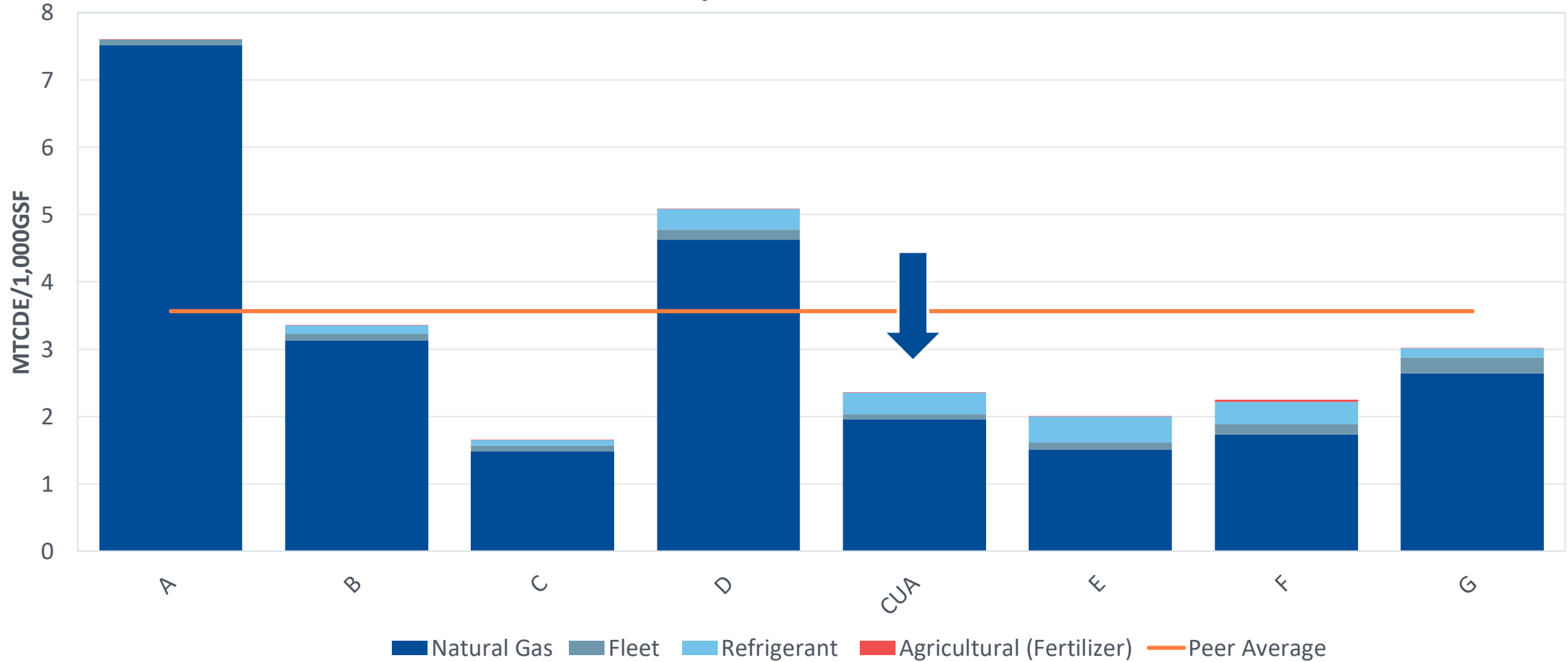
Heating Fuel Consumption Compared to Demand (Degree Days)



# Normalized Scope 1 Emission Compared to Peers

*CUA's scope 1 emissions are less than peer average.*

Scope 1 Emissions vs. Peers



# Scope 2

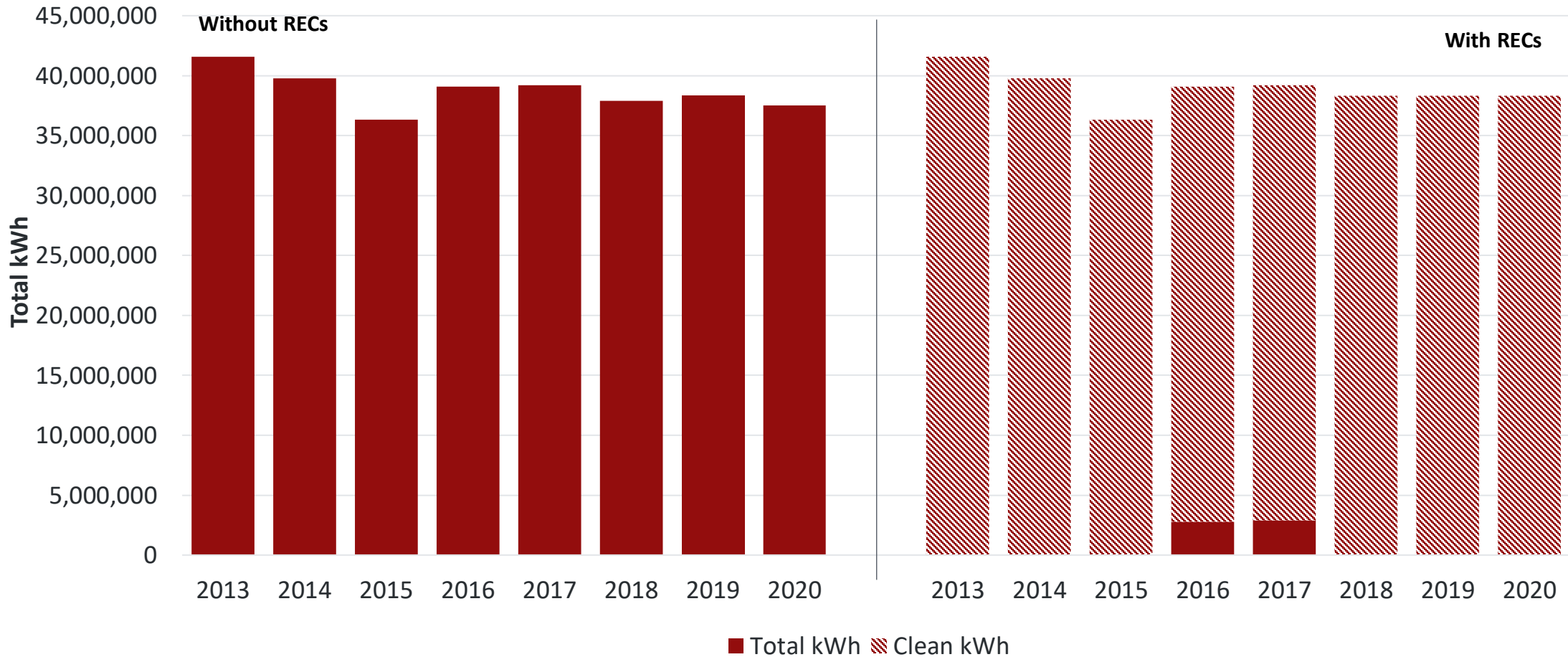




# Clean Energy Purchases Improve Scope 2 Profile

*CUA is impacting electricity consumption through purchase of RECs*

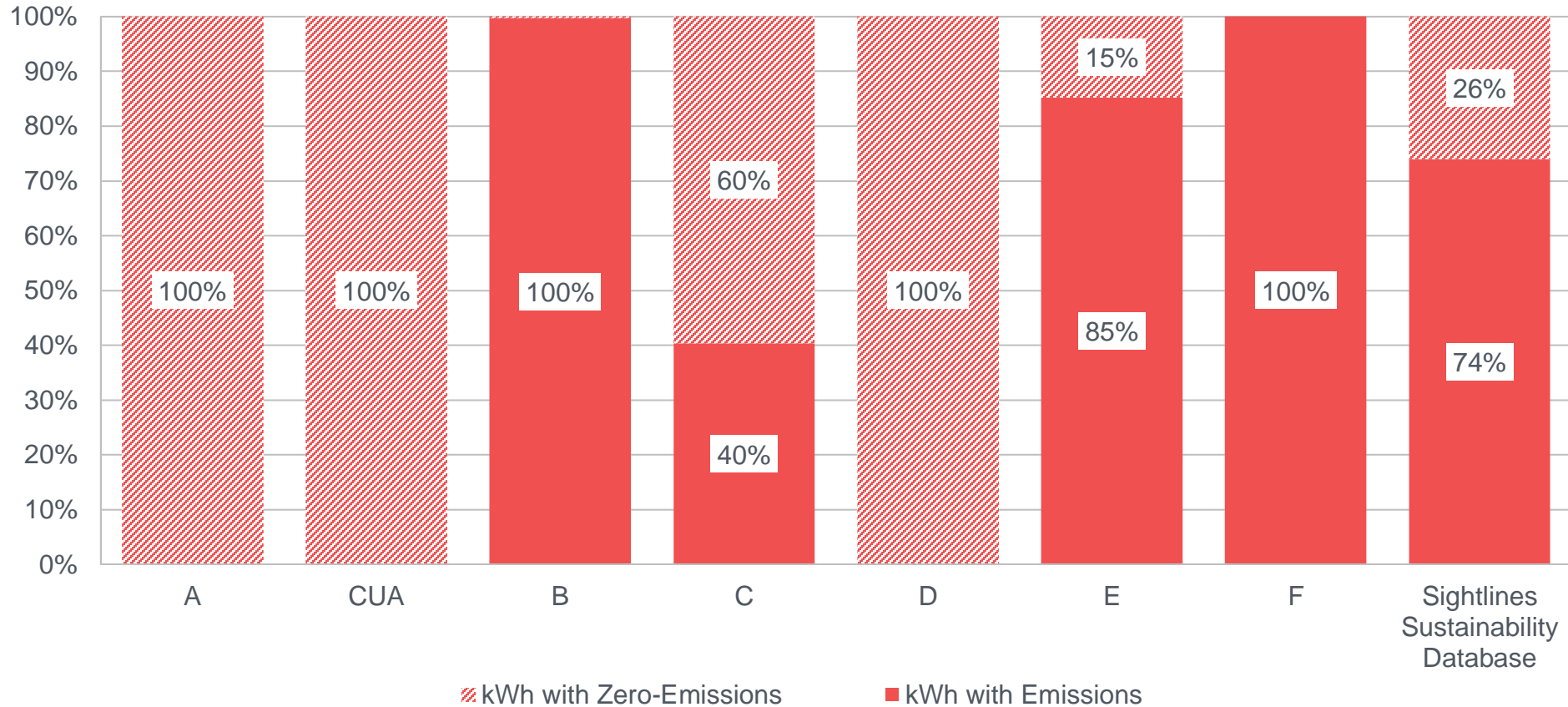
CUA Historical Energy Consumption



# Reducing Consumption and Clean Energy: A Balancing Act

Along with CUA, few other peers mitigate scope 2 emission 100% by purchasing Recs

Percent of Zero-Emissions Electricity (Sustainability Peers)



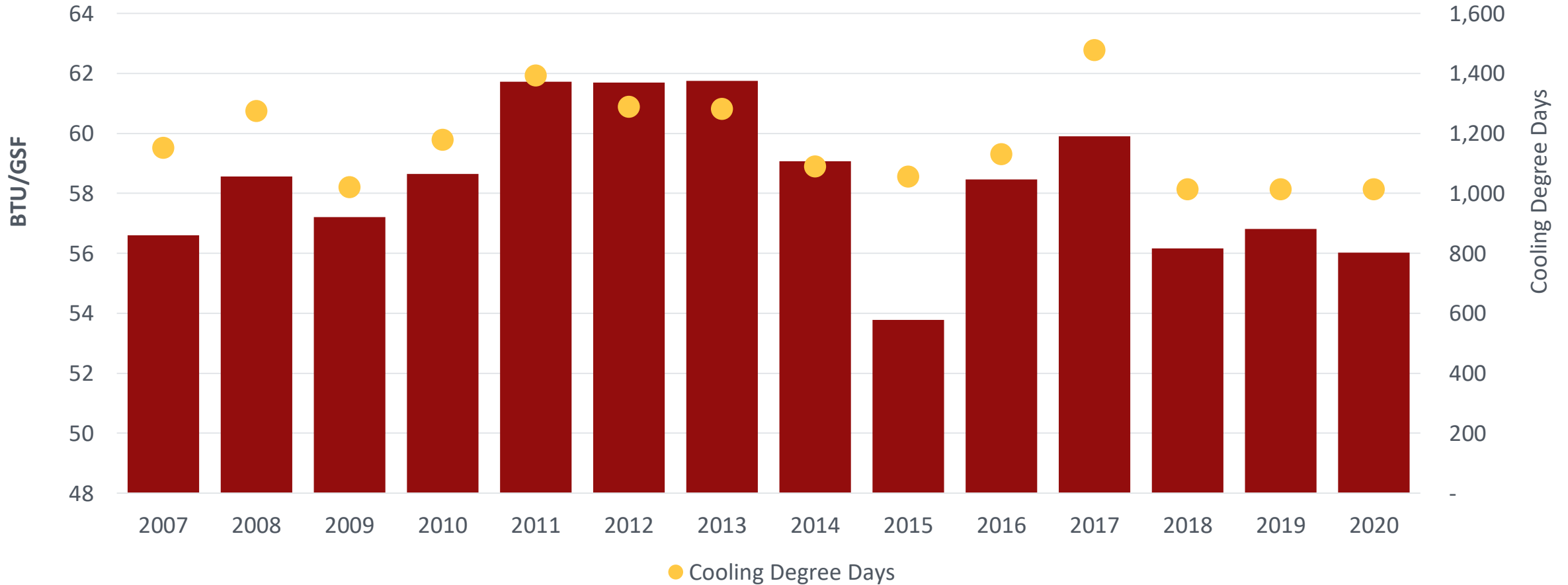
Clean Electricity Strategies Used by Peers:

- On campus solar panels
- RECs (additional renewable energy credits)
- Off Campus Solar PPAs

# FY20 Consumption Defied Weather Demand

*Consumption primarily driven by covid impacts and recent infrastructure projects on campus*

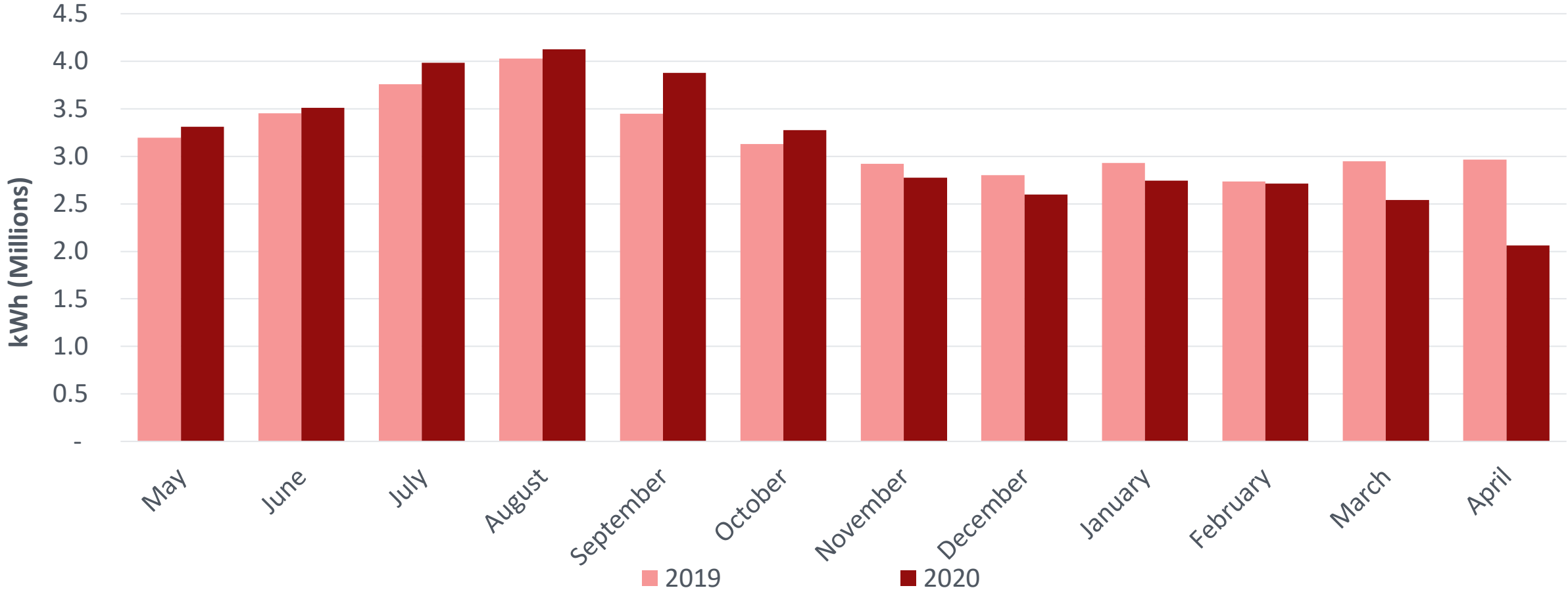
Electricity Consumption Compared to Demand (Degree Days)



# Electricity Consumption Comparisons Over Time

*Less consumption compared to previous year*

### Electricity Consumption by Month (FY19 vs FY20)



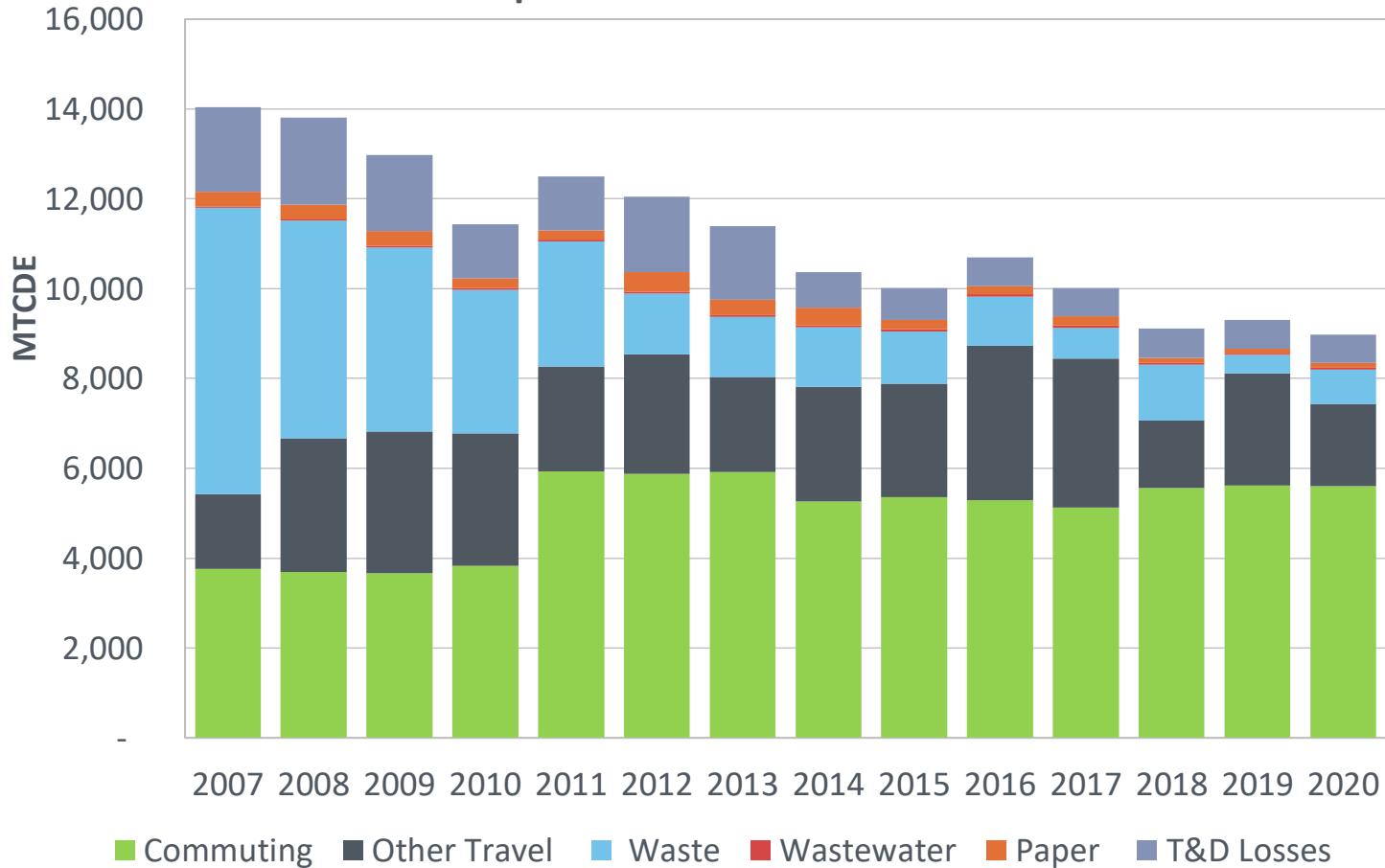
# Scope 3



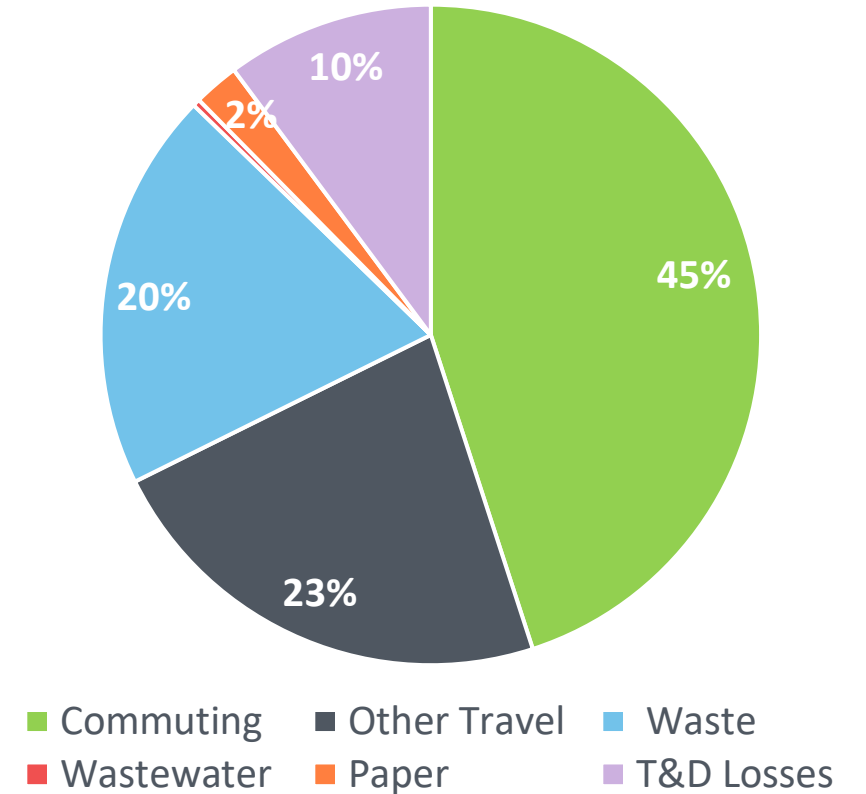
# Commuting Trending Over Time And FY20 Breakdown

Commuting Makes Up 45% Of Total Scope 3 Emissions

Scope 3 Emissions Over Time



FY20 Scope 3 Emissions

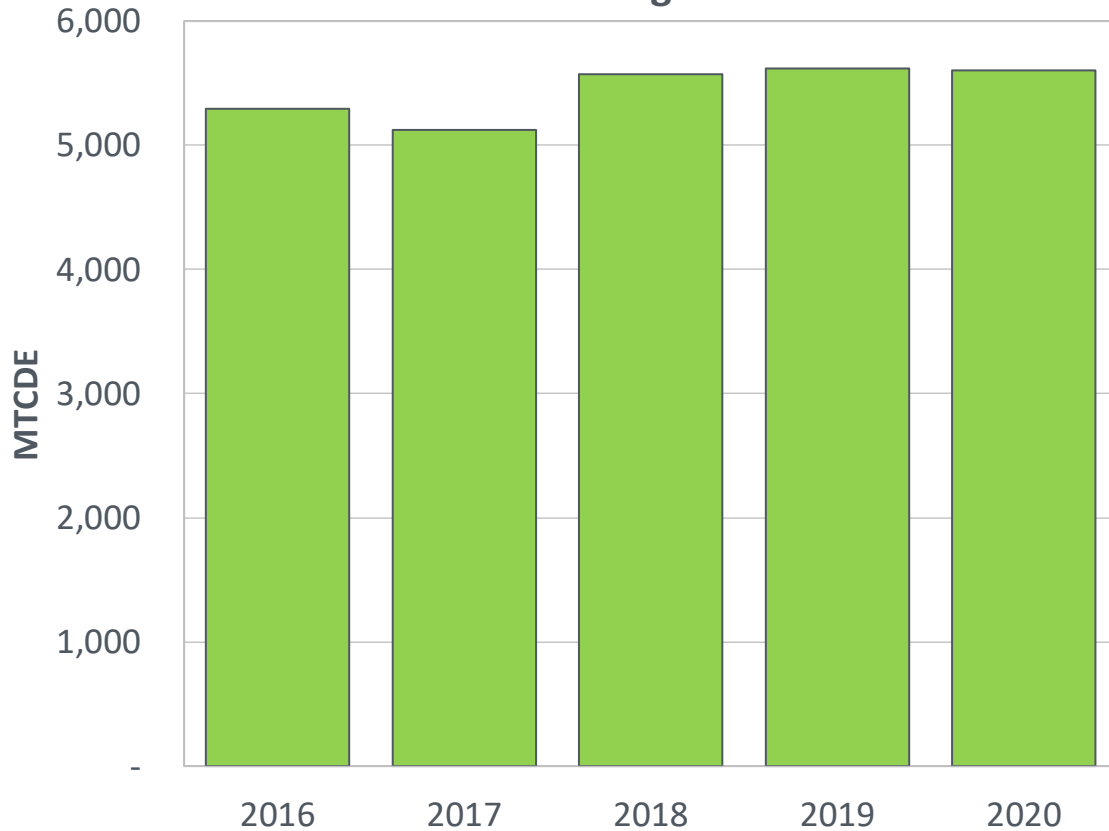


Other Travel- Directly financed/Study abroad

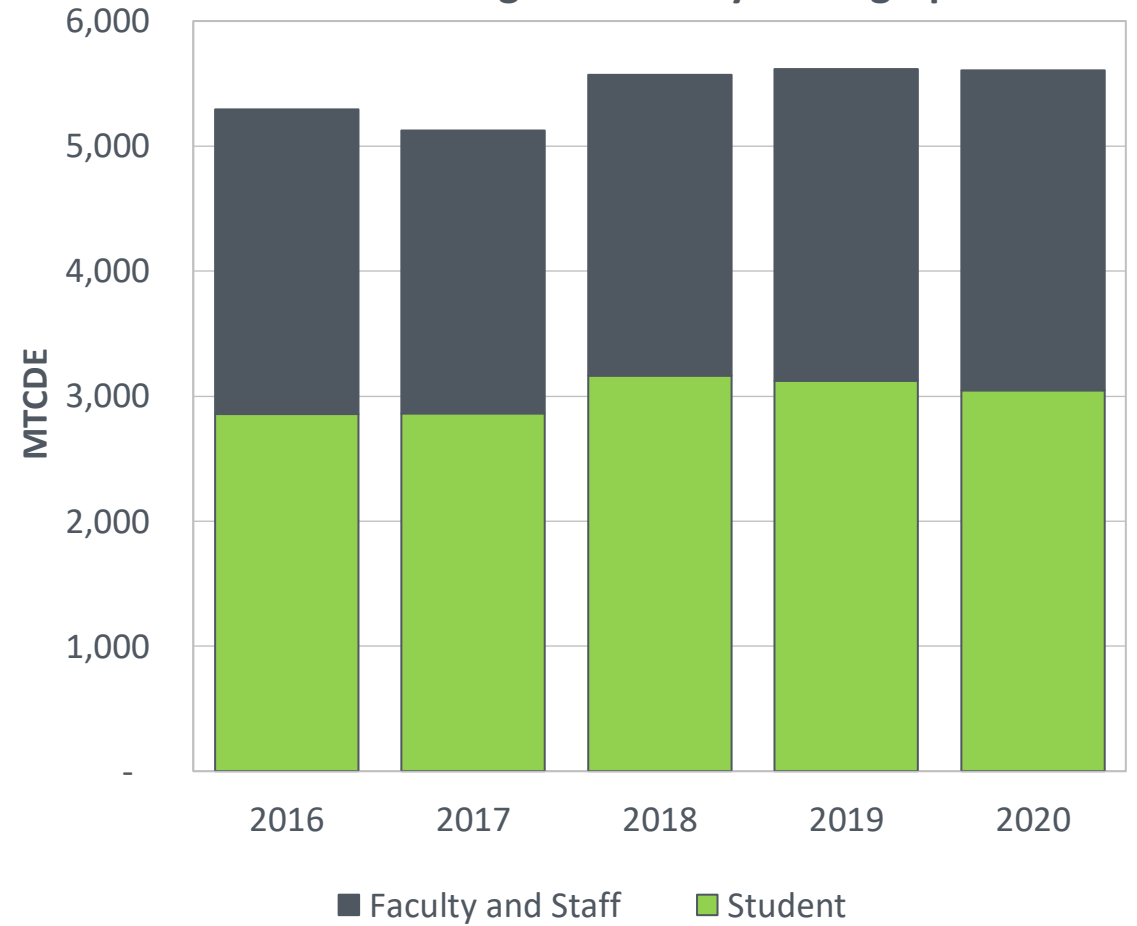
# Commuting Emissions by Users

*Commuting Emissions have remained steady over time*

**Total Commuting Emissions**



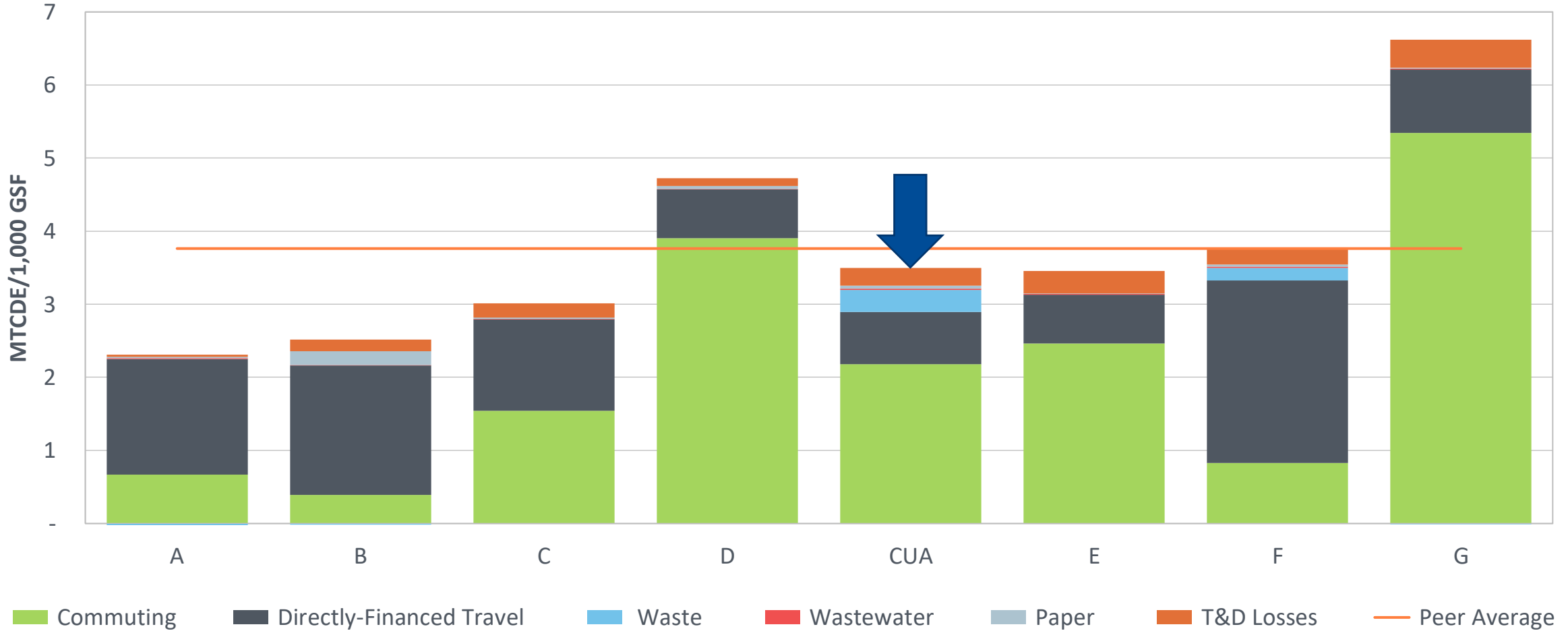
**Commuting Emission by Demographic**





# Normalized Scope 3 Emissions Compared to Peers

Scope 3 Emissions vs. Peers



Arrayed by density

# Concluding Comments



# Carbon Management

## Step 1: AVOIDANCE:

Don't consume energy

## Step 2: ACTIVITY:

Consume less by increasing efficiency

## Step 3: INTENSITY:

Switch high-carbon energy sources for low-carbon ones

## Step 4: OFFSET:

Offset the emissions from consumption

# Carbon Management – Scope 1

**Step 1: AVOIDANCE:**  
Don't consume energy

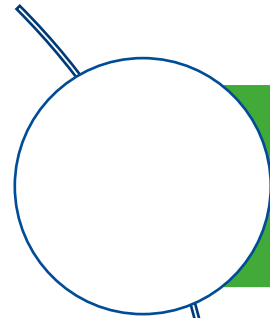
**Step 2: ACTIVITY:**  
Consume less by increasing efficiency

**Step 3: INTENSITY:**  
Switch high-carbon energy sources for low-carbon ones

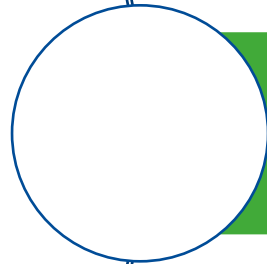
**Step 4: OFFSET:**  
Offset the emissions from consumption

Examples:	Scope 1	Scope 2	Scope 3
<b>Avoidance</b>	Avoid consuming fossil fuels through individual actions like lowering the thermostat and insulating windows.	Avoid consuming electricity through individual actions, like turning off lights and unplugging chargers	Avoid commuting emissions through individual actions, like carpooling or not idling on campus.
<b>Activity</b>	Utilize a decentralized low temperature hot water system. Replace/repair leaking steam lines and manholes. Focusing on building envelope projects to allow buildings to function more energy efficiently	Switch to LED bulbs on campus. Use a building automation system. Installed thermal and electric energy meters/submeters in all buildings.	Implement policies that encourage alternative carbon-free methods of commuting (biking, walking).
<b>Intensity</b>	Switch from Natural Gas to Biofuel.	Consume green energy on-site or by partnering with off-site organizations.	Go Electric or Hybrid.
<b>Offset</b>	Offset remaining emissions.	Offset remaining emissions.	Offset remaining emissions.

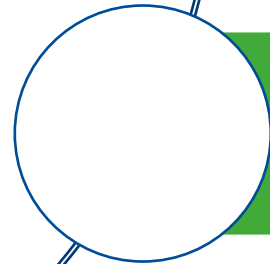
# Key Takeaways



**Scope 1:** CUA's Scope 1 Emissions are driven largely by Natural gas consumption. Emissions decreased in FY20.



**Scope 2:** CUA's Scope 2 emissions lowered through the purchase of RECs. Policy and capital investments will continue to decrease the need for scope 2 REC purchases.



**Scope 3:** CUA Scope 3 emissions are largely driven by behaviors of users on campus – specifically in commuting and travel.

# Appendix/Peer Insights



# American University Path To Carbon Neutrality

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- **Hot water infrastructure project** - AU transitioned from a centralized steam plant to a decentralized low temperature hot water system which will decrease natural gas and electricity use substantially.
- **100% of AU's electricity comes from a renewable source through a combination of on-site solar, a large solar farm in North Carolina that generates half of their electricity, and Renewable Energy Credits.** AU is Investigating partnering with more PPA's and considering on-campus solar panels. Currently, AU rents solar panels from a utility company, so while they are on AU's campus, AU does not own them.
- **AU works with the city to provide public transit to and from campus.** AU offsets the carbon emissions caused by students, faculty and staff members who commute to campus by planting and nurturing 650 trees throughout the nation's capital. AU is considering an electric fleet, but that is not an immediate priority.
- **The university purchases renewable energy and offsets to balance the greenhouse gas emissions it produces.** AU is now trying to limit dependency on offsets to be carbon neutral by seeking renewable energy sources and alternate heating sources.



# Urban Forestry – Duke Carbon Offsets Initiative



Photo courtesy of Yunian Deng CC BY

Urban Forestry  
Carbon Offset Protocol 2.1  
March 14, 2018



## Highlights

- DCOI has pioneered 7 urban forestry pilot projects throughout North Carolina, Arizona, and New York.
- Partnered with Arizona State University, Elon University, Davidson College, Pace University, and Green Mountain College.
- The Urban Forestry Protocol will result in over 6,400 trees planted by the end of 2017.
- DCOI has written recommendations for how to quantify on-campus trees and forests to ensure additionality.



*In 2016 and 2017, the DCOI has 6 tree planting projects with the majority being in North Carolina.*

**Permanent** – The reduction must last in perpetuity;

**Additional** – The reduction would not have occurred during a business-as-usual scenario;

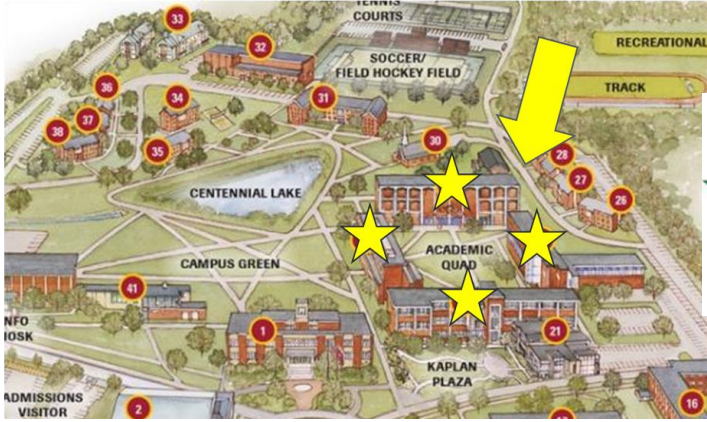
**Verifiable** – The reduction must have been monitored and confirmed to have occurred;

**Enforceable** – The reduction must be counted only once and then retired; and

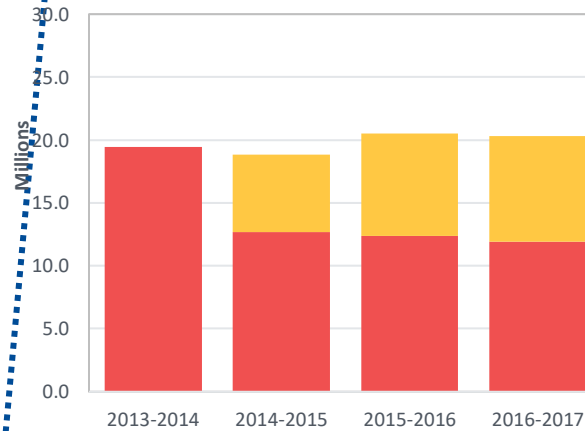
**Real** – The reduction must actually have occurred and not be the result of flawed accounting.

# Rider University Tri- Generation Plant

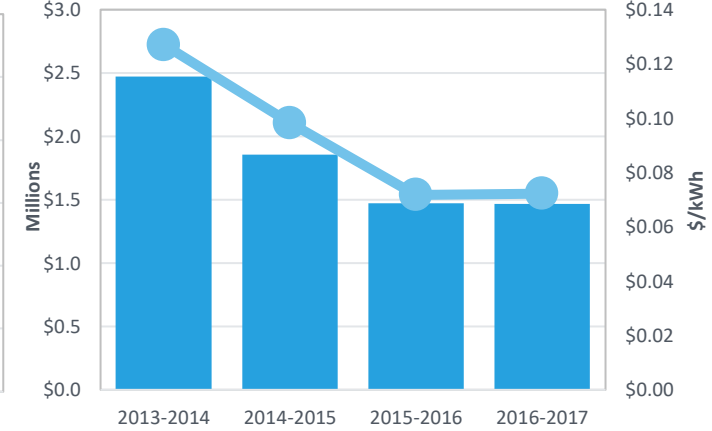
Lawrenceville Campus: 1,263,779 GSF



Electric Consumption Profile



Electric Spending



Why?

- 2010: Carbon Neutral Plan
- New Jersey State's Clean Energy Program

Scope:

- Academic quad: 4 Buildings
- 224,920 GSF (17% of campus)

Generates:

- Electricity
- Hot Water
- Chilled Water

- Over 66% efficiency vs. 33% regional electric utility
- Saves over 3M gal. of H<sub>2</sub>O per year

Reducing emissions per year

9,951 lbs. in NO<sub>x</sub>

17,399 lbs. in SO

101g in Hg

3,200 tons in CO<sub>2</sub>

# West Chester University's Geothermal System

## Why?

- 50 yr. old steam system
- Campus expansion plans
- Attention to sustainability & climate impacts
- GESA – 15 yr. program to reduce energy cost by 20-25%
- State Support

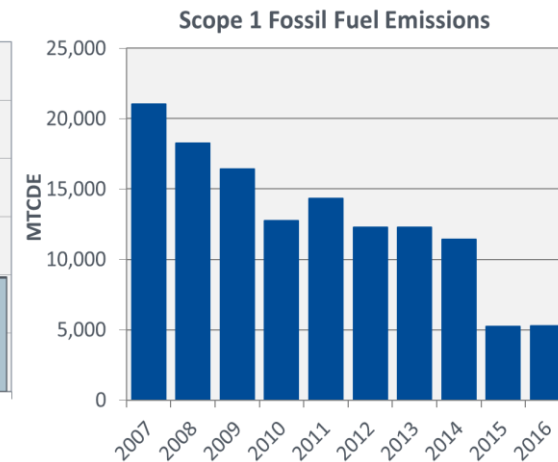
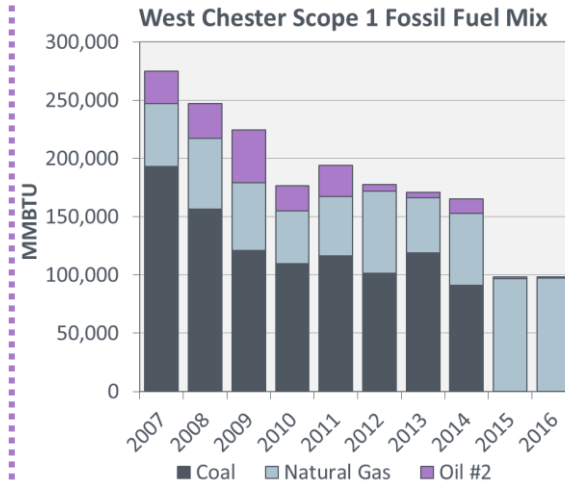
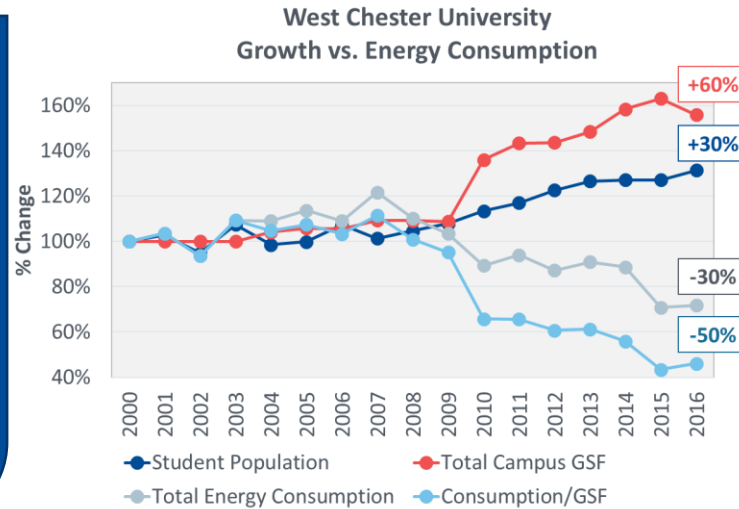
Buildings converted through Phase III: 11 Wells built through Phase III: 836

- Phase I: Completed 2008-09**
- Buildings converted: 519,000 GSF
  - Wells constructed: 350
- Phase II: Completed 2009-14**
- Buildings converted: 391,000 GSF
  - Wells constructed: 88
- Phase III: Completed 2014-17**
- Buildings converted: 215,800 GSF
  - Wells constructed: 398
- Phase IV: Future (2020+)**
- Buildings to be converted: 604,000 GSF
  - Wells to be constructed: 140



## Project Benefits

- Decrease in energy consumption despite growing campus
- Increase efficiency
- Utility cost savings
- Environmental Benefits





# Arizona State University

*Over 50 MW equivalent solar generating capacity development from both on-site and off-site components.*

- **On-site Program Milestones as of June 30, 2018**
  - **Solar Generation Capacity:** 24.1 MW equivalent
  - **Solar kWh Equivalent FY 2018:** 39,616,262
  - **Solar Systems:** 89
  - **PV Panels Installed:** 82,456
  - **CPV Modules Installed:** 8,652
  - **Solar Collectors Installed:** 7,840
  - **Shaded Parking Spaces:** 5,952
  - **Shaded Stadium Seats:** 828

- **Off-site Program Milestones as of June 30, 2018**

- The ASU Red Rock Solar Project is a collaboration between ASU and APS in which APS constructed and operates a solar energy generating facility at Red Rock, Arizona. Beginning January 2017, ASU has committed to purchase 65,000 MWh per year of solar-generated electricity from APS.
- **Solar Generation Capacity:** 28.8 MW
- **Solar kWh FY2018:** 65,000,004
- **PV Panels Installed:** 91,440

# Examples of Sustainability Goals on Smaller Projects

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- **Lighting**

- Incandescent lights are not used unless required in a historic structure or in specialty areas such as a museum or art building.
- Lighting controls are used to regulate lighting levels according to the amount of natural daylight entering the building.
- Corridors and public spaces are designed to allow for generous amounts of natural daylight to flood the spaces.
- Occupancy motion sensors are used to control lighting.

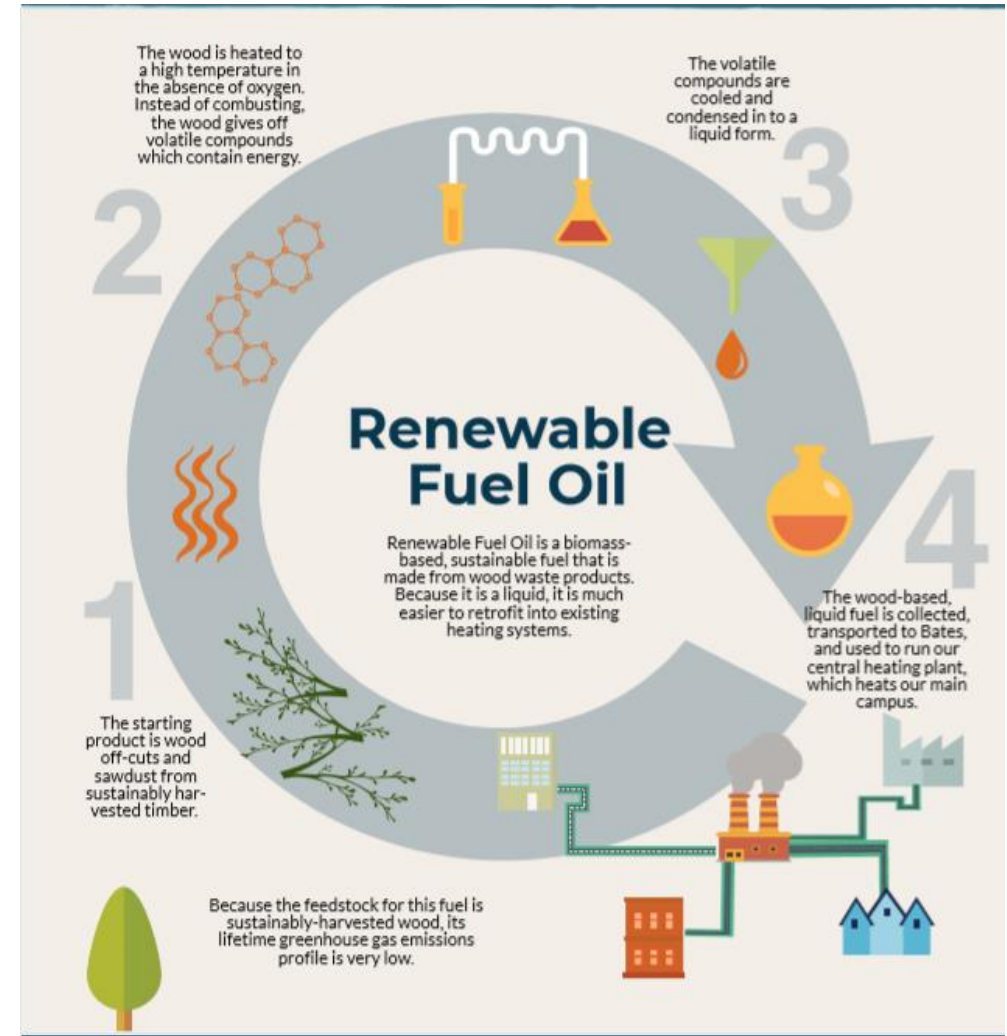
- **Heating and Cooling Standards**

- During the heating season, thermostats are set at 68 +/- 2 degrees F. During the cooling season, thermostats are set at 76 +/- 2 degrees F.
- Separately zoned systems to serve areas with different users
- Programming HVAC for different modes according to whether spaces are occupied or unoccupied
- Computer server rooms on separate systems to accommodate constant cooling needs
- Distributed air-handling mechanical rooms to reduce the size and complexity of ductwork systems
- Use of heat-recovery systems
- Use of state-of-the-art computers to control operation of systems

# Bates College

*The first campus nationwide to use **Renewable Fuel Oil**, Bates is heated by clean and sustainably sourced energy.*

- What is it?
  - Renewable fuel oil is a biomass – based, sustainable fuel that is made from wood waste products. Because it is a liquid, it is much easier to retrofit into existing heating systems.
- Bates College converted their central steam plant (which provides heating for 80% of their buildings) from natural gas to renewable fuel oil which is a heating oil substitute made from tree offcuts.
- Renewable Fuel Oil has a greenhouse gas footprint of only 15% of heating oil, and is 100% renewable.



# Colby College – Sustainable Transportation

- 6 Electric vehicle (EV) stations located around campus
- Reserved parking spots throughout campus for low emissions vehicles (LEVs)
- Colby Shuttle: provides service between downtown Waterville and the campus on Mayflower Hill
- Jitney: free student driven taxi provides daily service to anywhere in Waterville
- ZipCar: Colby owns 3 ZipCars. Can be used by both students and employees. Online signup and hourly fee to use ZipCar which includes gas
- iBike: Began in 2008, program offers free bike loans to students and employees. Bikes come with helmet and lock and may be checked out for up to 24 hours at a time.
- Rideboard: Students can post asking for and offering rides to help promote carpooling and assist students without cars get to where they need to go
- Weekend Shuttle
- Airport Shuttle

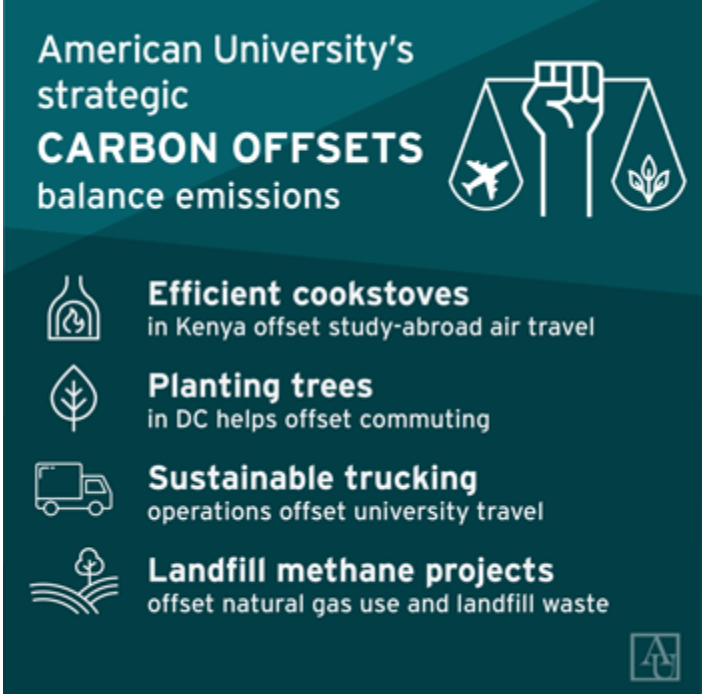








# American University Carbon Offsets

“American University became the first university, first research university, and first urban higher education campus to achieve carbon neutrality. This major goal was reached two years ahead of the initial target of 2020” <https://hub.aashe.org/browse/casestudy/19674/American-University-Achieved-Carbon-Neutrality-Two-Years-Ahead-of-2020-Target>

- Student, Faculty and Staff Commuting
  - Facilitated by Urban Offsets, a portion of AU’s carbon offsetting funds will be used to plant and care for 650 trees in the D.C. area. Local homeowners will also benefit from this initiative through onsite stormwater management. <https://www.american.edu/media/news/20180418-carbon-offset-program-launched.cfm>
- Study Abroad Air Travel
  - 7,000 MTCDE worth of carbon offsets were purchased in FY17
  - AU invested in the Paradigm Project, an endeavor that benefits communities in Africa by empowering women, providing jobs for women, and reducing greenhouse gas emissions through reduced deforestation.
  - Offers financial assistance to families in Kenya to help pay for wood-burning cook stoves
  - The stoves are designed to burn wood efficiently thereby reducing the amount of firewood the women in the community will need to collect as well as improving indoor air quality for families. <https://reports.aashe.org/institutions/american-university-dc/report/2018-02-28/OP/air-climate/OP-1/>



**American University's strategic CARBON OFFSETS balance emissions**

-  **Efficient cookstoves**  
in Kenya offset study-abroad air travel
-  **Planting trees**  
in DC helps offset commuting
-  **Sustainable trucking**  
operations offset university travel
-  **Landfill methane projects**  
offset natural gas use and landfill waste

- Creative Arts House (100 Broad St.) Thermal Solar Energy
  - In 2013, Solar panels were installed on the side wall of the Creative Arts House (100 Broad Street).
  - The solar thermal panels will eliminate the use of nearly 900 gallons of fuel oil while reducing heating costs by over \$2,600 each year.
  - The 600 square-feet of solar panels will reduce Colgate's carbon footprint by over 9 tons.
  - Since these systems can last for over 20 years, this turns out to be a good deal for both Colgate's energy budget and for the planet
- Chapel House Geothermal Energy System
  - In 2016, Colgate installed a geothermal energy system beneath the Chapel House.
  - This geothermal system will reduce Colgate's carbon footprint by 50 tons each year, and 28,000 MMBTUs over its 30-year life time.
  - This \$155,400 project will save the university \$22,000 in annual energy costs, paying for itself in just 7 years.
  - It is estimated to save the university a total of \$660,000 over time.
- Biomass Heating Plant and Willow Plot
  - Colgate's wood-fired boiler, installed in the early 1980's, is one of the university's longest-standing sustainability initiatives.
  - Each year, this renewable, carbon-neutral resource helps Colgate avoid consuming about 1.2 million gallons of fuel oil, 13,800 tons of emissions, and saves the university approximately \$1.8 million in heating costs.
  - In May 2009, Colgate planted 60,000 willow shoots a mile from campus in an effort to grow some of its energy. Over a 20-year period, this plot will yield about 900 dry tons of biomass for the university's woodchip burning facility.



<http://blogs.colgate.edu/sustainability/2013/09/30/solar-energy-at-gate-one-step-closer-to-climate-neutrality/>

<http://blogs.colgate.edu/sustainability/2017/01/27/sustainability-showcase-chapel-house/>

<http://news.colgate.edu/2009/05/willow-experiment-aims-to-gene.html/>

- Colgate signed a **15 year commitment** with Patagonia Sur to purchase forestry based carbon offsets.
- Under the agreement, a total of **225,000** native-species **trees** were **planted on 430 acres** of land in Chile's Aysén Region of Patagonia.
- Annually, the forest will **offset** approximately **5,000 tons**, or about **one-third of** Colgate's present **carbon footprint**.
- The arrangement also provides Colgate with a research site for students and faculty, and a place to collaborate with member universities on research as well as the development of sustainability initiatives.
- Colgate's **local forest** has been certified by the American Tree Farm System for long-term sustainable management
- These trees have been inventoried and **sequester 1,578.0 MTeCO2 annually**.





# Amherst, Bowdoin, Hampshire, Smith and Williams Colleges

“Five leading liberal arts colleges partner to create new solar energy facility in Maine”

<https://www.competitive-energy.com/news/five-leading-liberal-arts-colleges-partner-to-create-new-solar-energy-facility-in-maine>



- 5 of the nations leading liberal arts colleges have formed a pioneering collaborative that will allow them to offset 46,000 megawatt hours per year of their collective electrical needs with electricity created at a new solar power facility to be built in Farmington, Maine.
- Partnered with a subsidiary of NextEra Energy Resources, the worlds largest generator of renewable energy from the wind and the sun
- The company will construct a universal-scale solar power facility that annually will create enough electricity to power about 5,000 New England homes.
- Each of the colleges will purchase zero-carbon electricity from the Maine site to reduce carbon emissions from campus electricity use. The facility is expected to open in 2019.



Middlebury  
College

## December 2016 Middlebury college became carbon neutral:

- Conversion of its primary fuel source for heating, cooling, and powering the campus from #6 oil to biomass gasification
- Partnership in three solar projects totaling 1.1 megawatts and retirement of the associated renewable energy credits
- Efficiency and conservation projects which reduced demand for electricity by 4.5 million kWh, a 15-20 percent reduction in demand
- The conservation of 2,100 acres of forest land it owned through an easement given to the Vermont Land Trust with minimal forest harvest allowed under very strict conditions in perpetuity

## How much did the biomass project cost and what is the payback?

- The project cost was \$12 million, which includes the construction costs for an 8,000-square-foot addition to the existing service building, alterations to other spaces within the existing building, the biomass gasification system, boiler, and control systems, plus design and permitting costs.
- At \$1.50 a gallon for #6 fuel oil and \$37 a ton for wood chips, the internal rate of return is 8.75 percent and the payback period is approximately 12 years. The switch to biomass from oil saves Middlebury around \$1,000,000 per year, with the expected savings increasing by 3 percent per year. The project will also pump \$1,000,000 annually into the local economy through the purchase of wood chips. The expected life of the plant is 25 to 30 years. We are continuously assessing new technologies with an eye toward greater efficiency for the plant and to be well-informed about our options when the plant is retired.

From <<http://www.middlebury.edu/sustainability/operations-and-action/biomass-gasification>>

# Arizona State University

*ASU partners with PayPal to purchase power from the 40 megawatt Red Rock Power Plant*

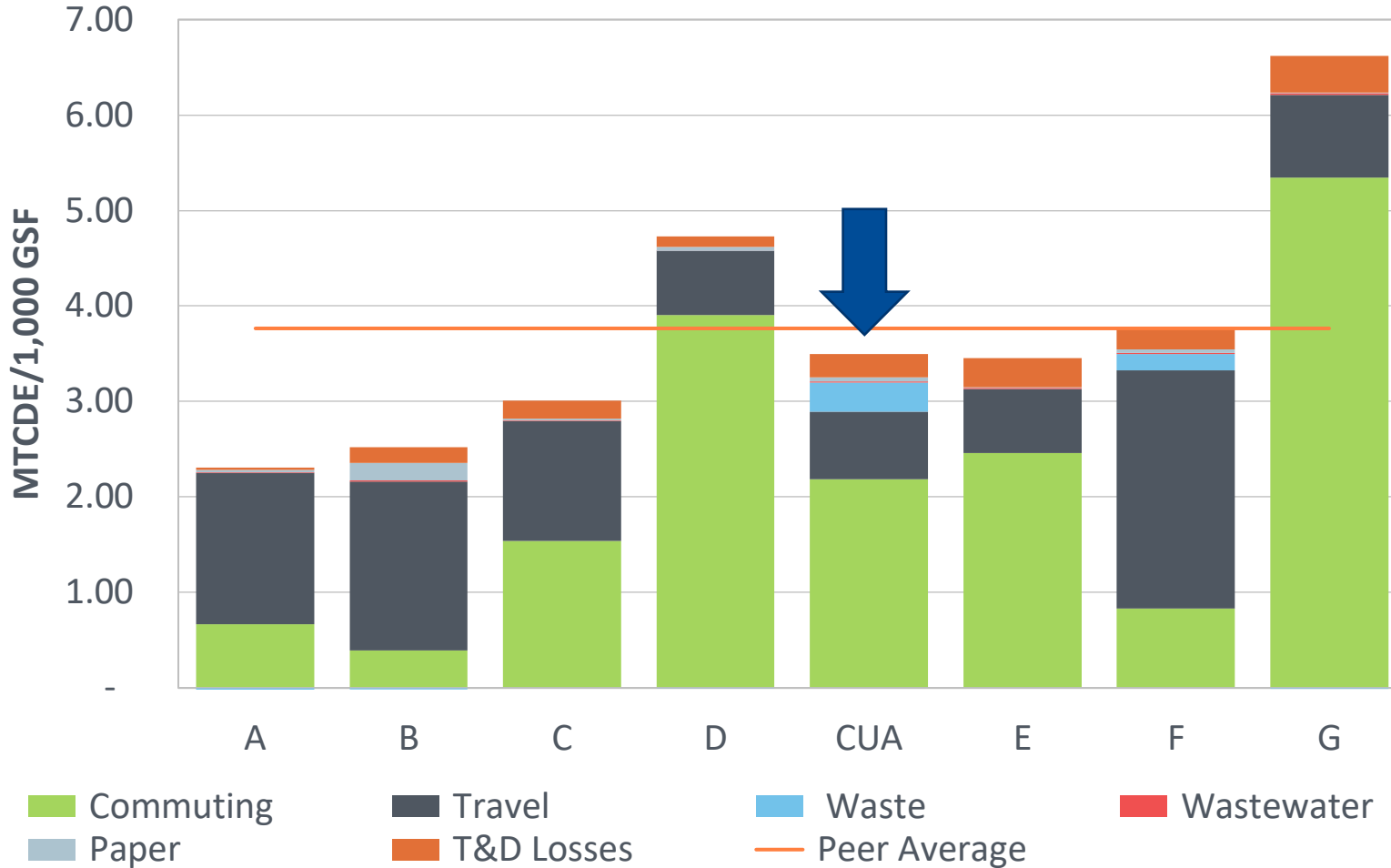
- Power from the plant won't go directly to ASU and PayPal, but the power they purchase from the facility is meant to compensate for traditional utility-grid power used at their facilities.
- The Red Rock Power Plant is on 400 acres of land near the Saguaro natural-gas fired power plant. The location allows the solar facility to take advantage of existing transmission lines and utility infrastructure.
- The plant has solar panels on tracking devices to follow the sun from east to west across the sky. Its 40-megawatt capacity is enough electricity to power about 10,000 homes at once, when sun is shining on the panels.



<https://www.azcentral.com/story/money/business/energy/2017/01/11/aps-dedicates-solar-plant-near-tucson-power-paypal-arizona-state-university/96449650/>

# Normalized Scope 3 Emission Compared to Peers

Scope 3 Emissions Over Time



Arrayed by density

## Peers With Low Commuting...

- Do not permit students in a full-time undergraduate program to have any vehicle on campus during their first year
- Participate in Commuter Benefit Programs, which allows employees to have pre-tax dollars deducted from their paycheck to purchase public transportation vouchers.
- Have public transportation readily available