GORDIAN®
Building knowledge

University of Alabama

FY19 Sustainability Solutions

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 Partners With SIMAP

THE UNIVERSITY OF ALABAMA®

At the end of 2017, Sightlines entered into a partnership with the Sustainability Institute at the University of New Hampshire, ensuring our Sustainability Solutions are always based on the most up-to-date science and methods.

They host *Sustainability Indicator Management & Analysis Platform* (SIMAP). This is a carbon and nitrogen-accounting platform that tracks and analyzes campus-wide sustainability based on nearly two decades of work supporting campus inventories.

University of New Hampshire®

SIMAP
SUSTAINABILITY INDICATOR MANAGEMENT & ANALYSIS PLATFORM

Distribution of Emissions by Level of Control

THE UNIVERSITY OF ALABAMA®

Scope 1 – Direct GHGs

- Natural Gas
- Vehicle Fleet
- Refrigerants
- Agriculture (Fertilizer)

Scope 2 – Upstream GHGs

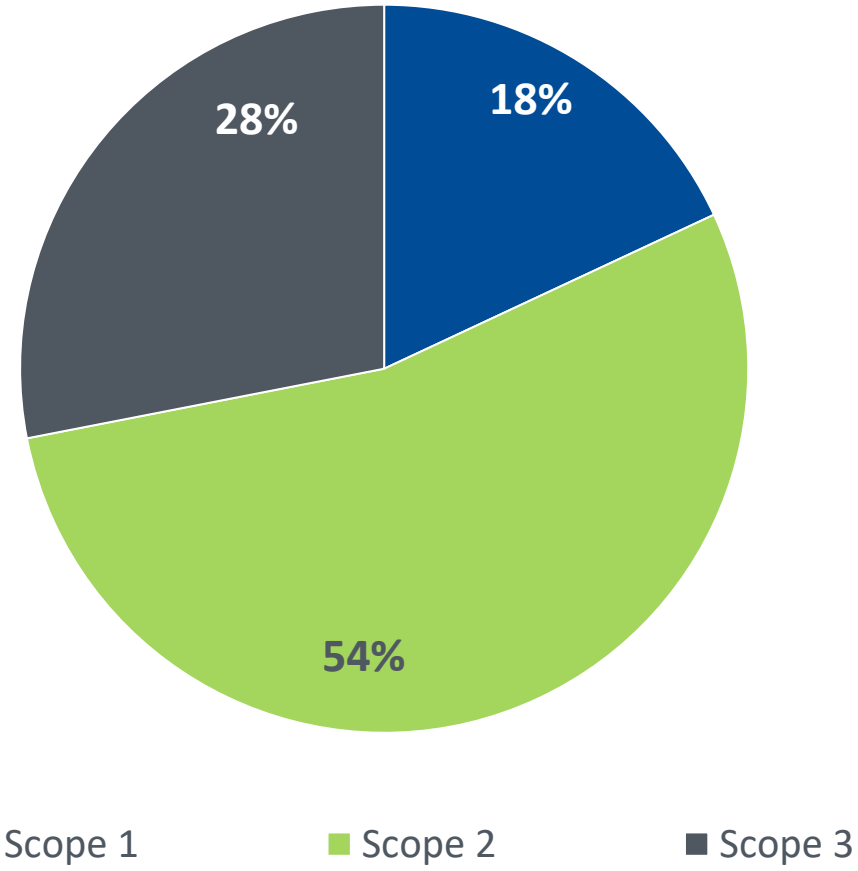
- Purchased Electricity

Scope 3 – Indirect GHGs

- Faculty/Staff/Student Commuting
- Directly Financed Travel
- Study Abroad Travel
- Solid Waste
- Wastewater
- Paper Purchasing
- Transmission & Distribution Losses

Less Control

FY19 Emissions by Scope

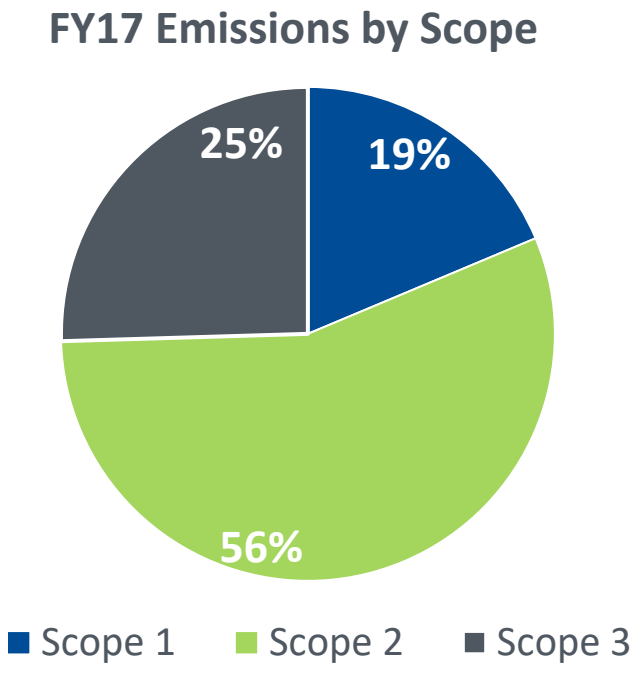


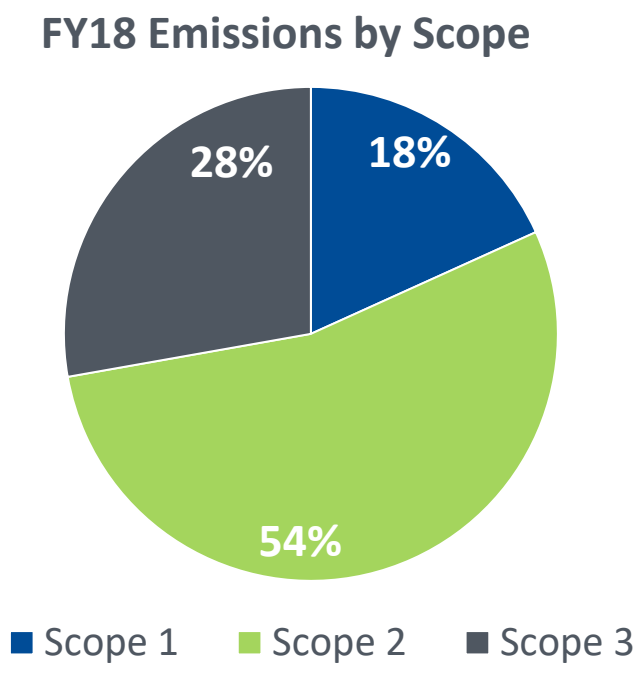
GORDIAN®

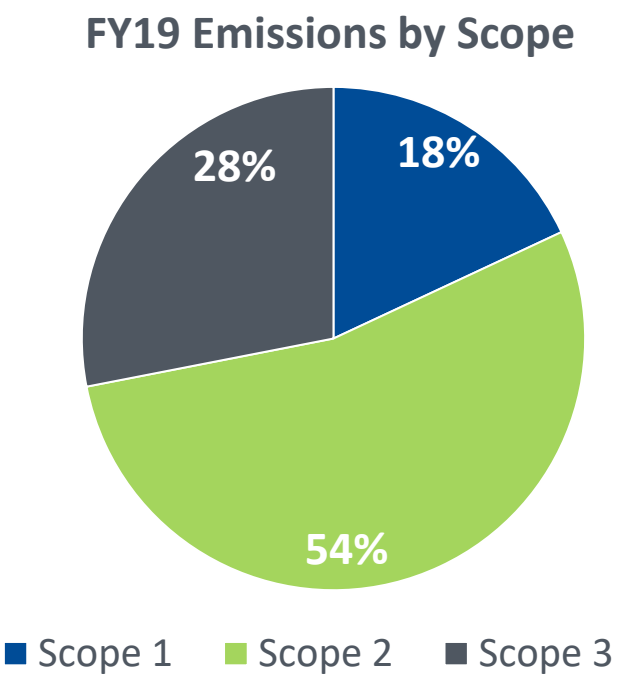
Consistent Distribution of Emissions Over Time

THE UNIVERSITY OF ALABAMA®

Emissions breakout maintains same balance as FY18, scope 2 emissions driving profile



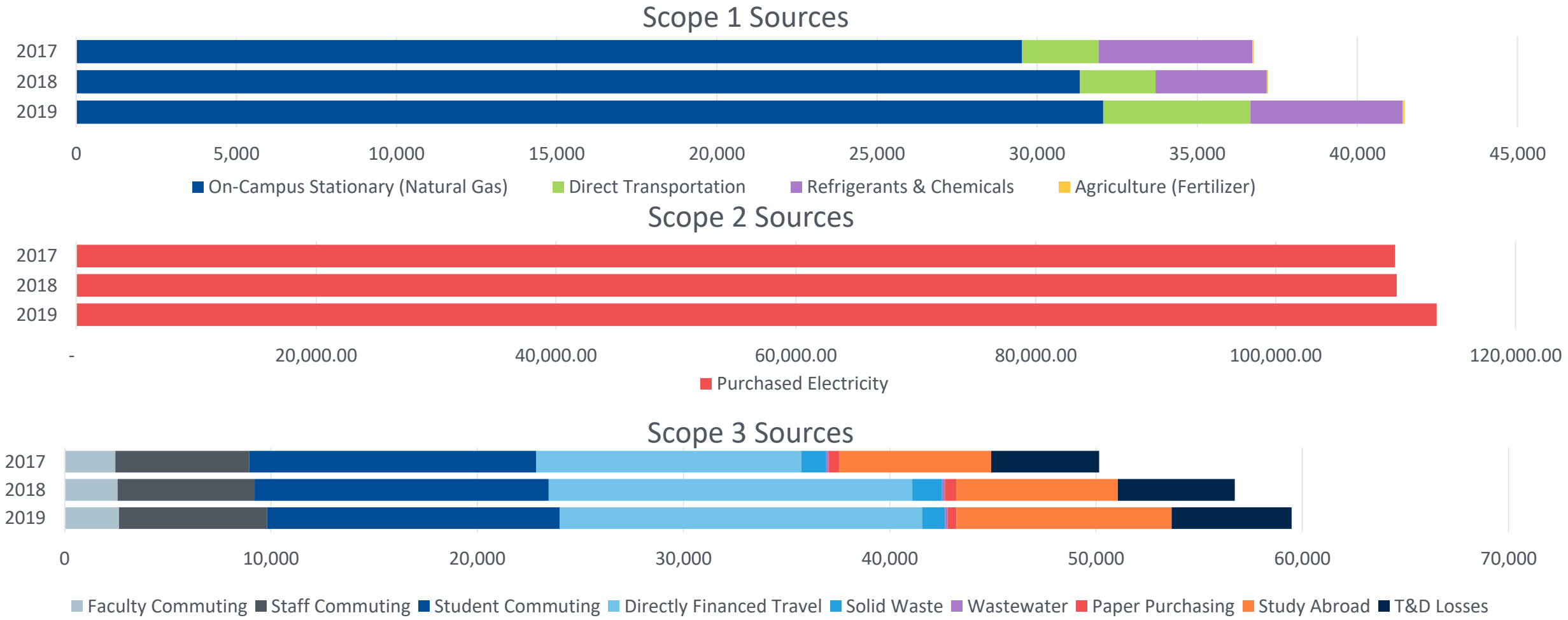




GORDIAN®

Segmenting Emissions by Scope

Energy use is the most impactful contributor to emissions profile



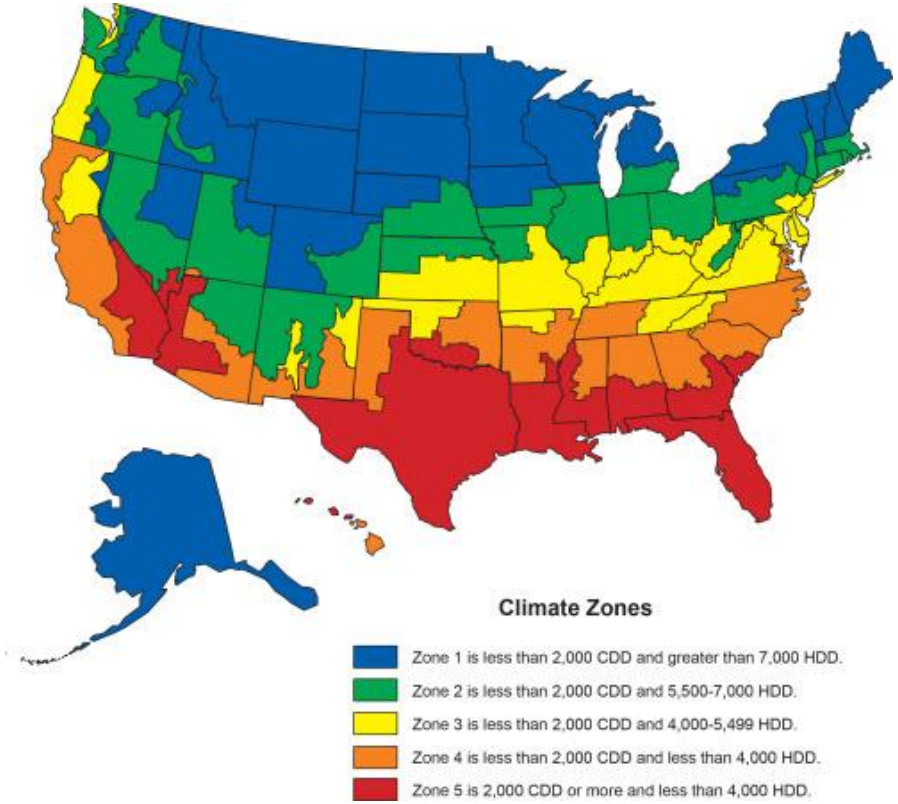
**Sources measured in MTCDE*

Comparative Peers

The University of Alabama is located in climate zone 4

Peer Institutions	Location
Arizona State University	Tempe, AZ
Clemson University	Clemson, SC
Towson University*	Towson, MD
University of Texas – Rio Grande Valley*	Edinburg, TX
Texas A&M University	College Station, TX
University of Arkansas	Fayetteville, AR
University of Tennessee	Knoxville, TN
Virginia Commonwealth University	Richmond, VA

*= New Peer in FY19



Sustainability Solutions Measurement and Analysis Members

- Sightlines has over 50 Sustainability Solutions Members
- Approximately two-thirds are private
- Approximately two-thirds have signed the ACUPCC
- Approximately forty percent are Charter Signatories

Benchmarking GHG Emissions

Two ways to normalize: by Campus User & by GSF

GHG Emissions per 1,000 EUI Adjusted GSF

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

Stresses efficient use of space.

*EUI Adjusted GSF weighs Science Research and Medical Space more heavily

GHG Emissions per Weighted User

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

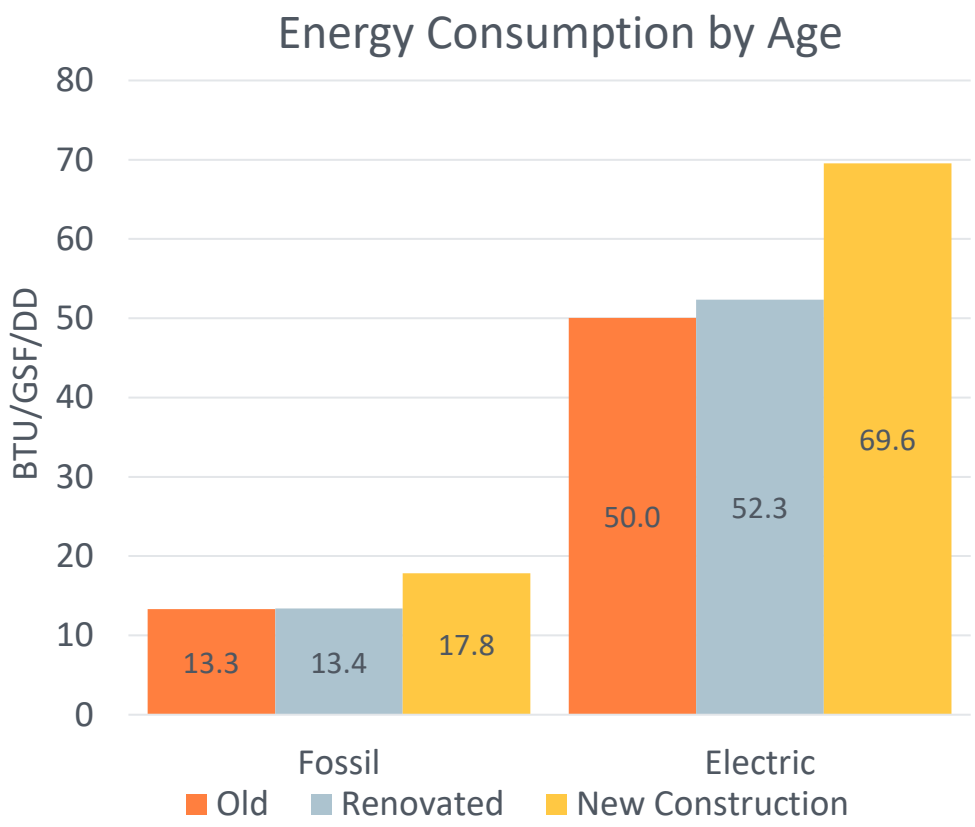
Stresses intensity of operations and commuting.

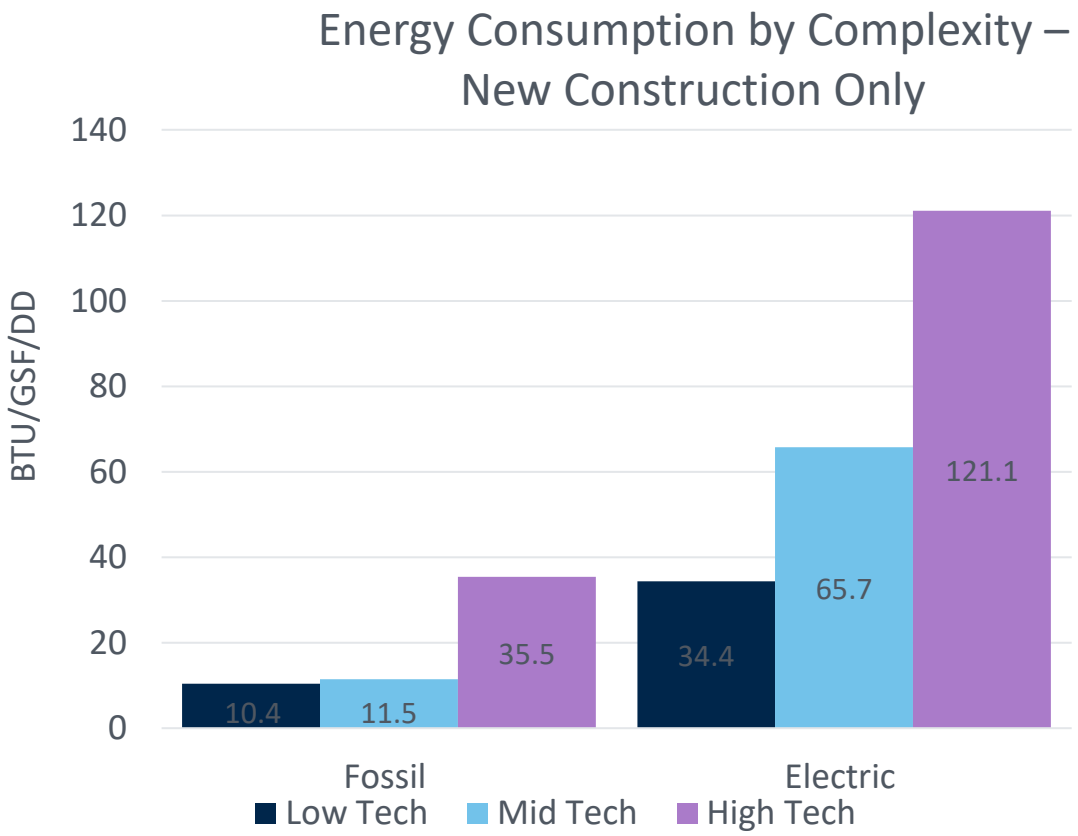
*Weighted User weighs full-time residential students more heavily

Campus Space Profile Impacts Sustainability Effort

THE UNIVERSITY OF ALABAMA®

Age and technical complexity of buildings on campus impact energy consumption and efficiency





New construction systems can be more efficient, but high tech complexity increases energy consumption

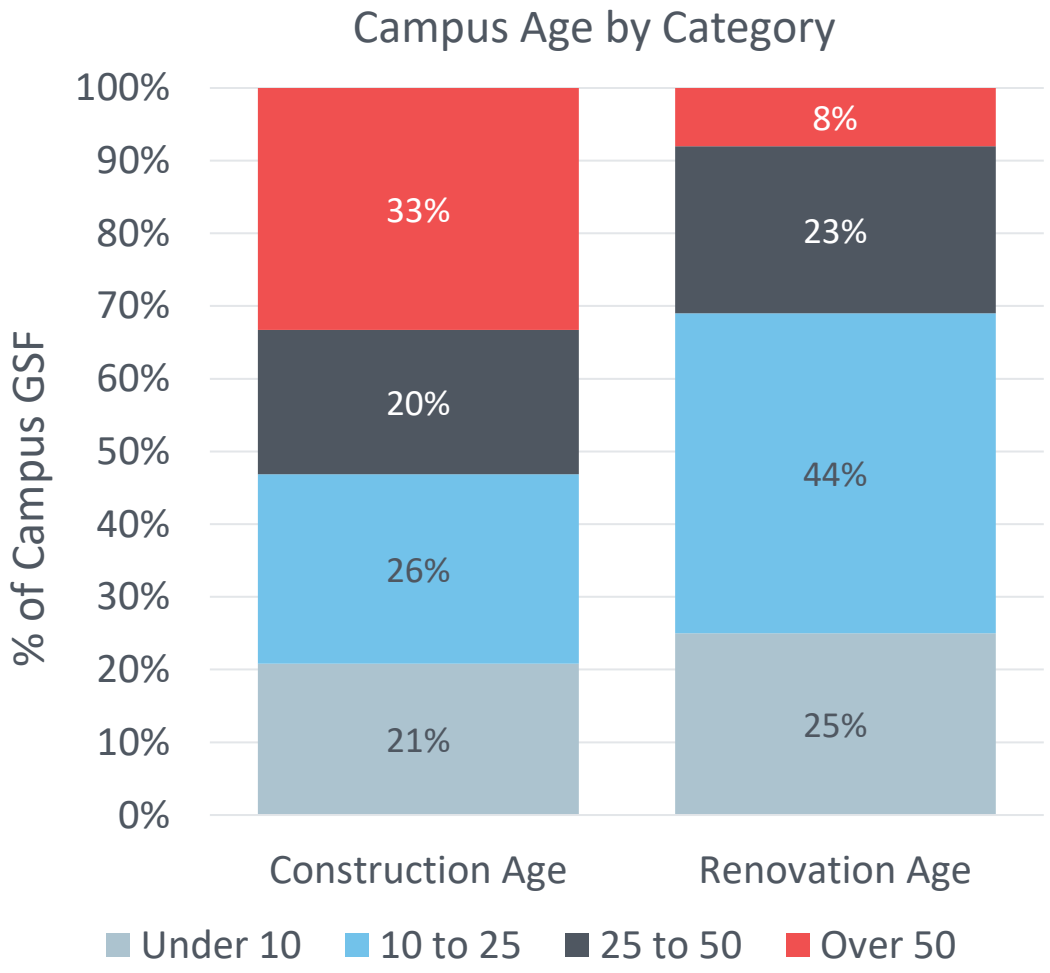
Technically complex (high tech) systems tend to consume more energy

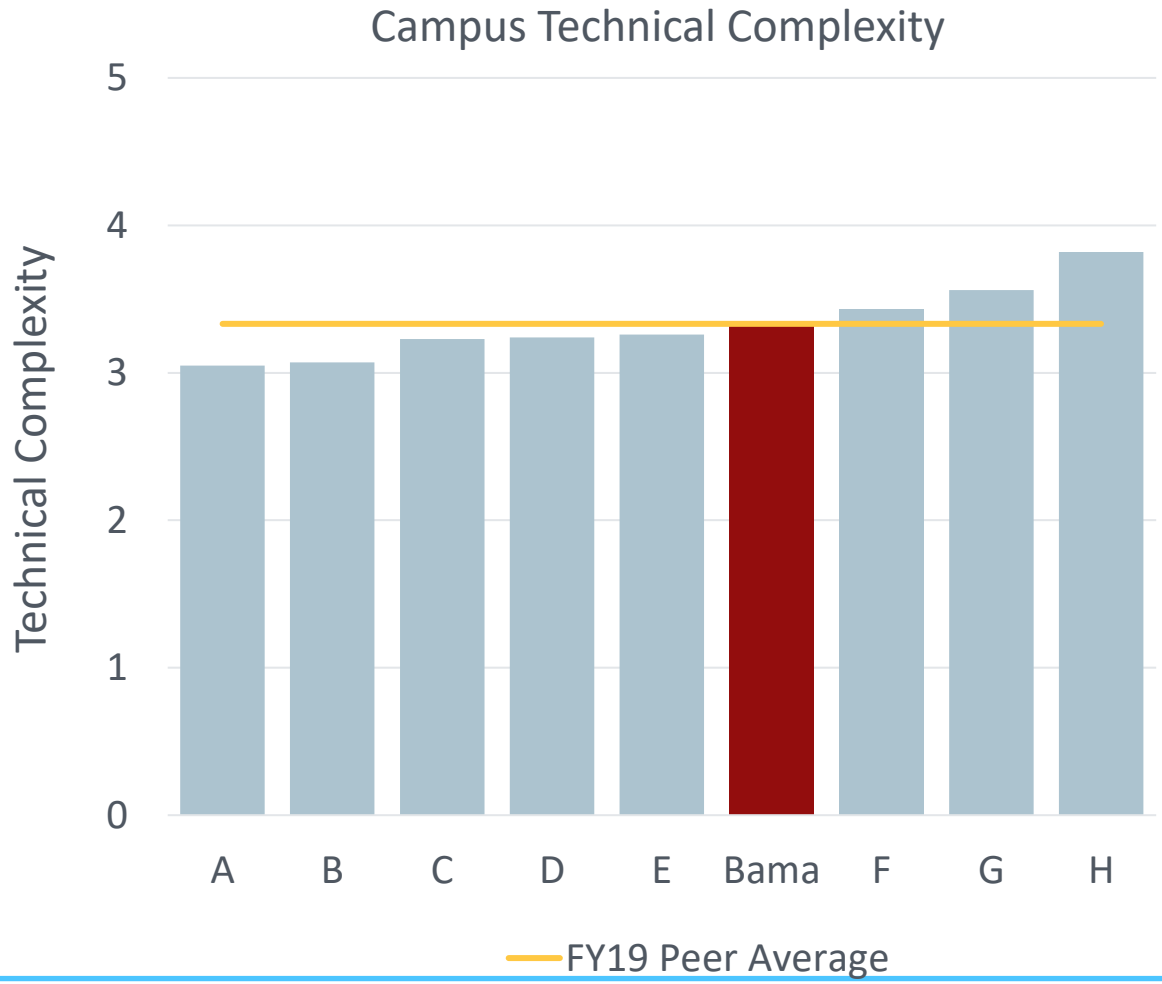
**Graphs taken from Sightlines State of Sustainability FY17*

GORDIAN®

Age Profile Impacts Energy Consumption

Reducing campus age through new construction creates potential for higher consumption



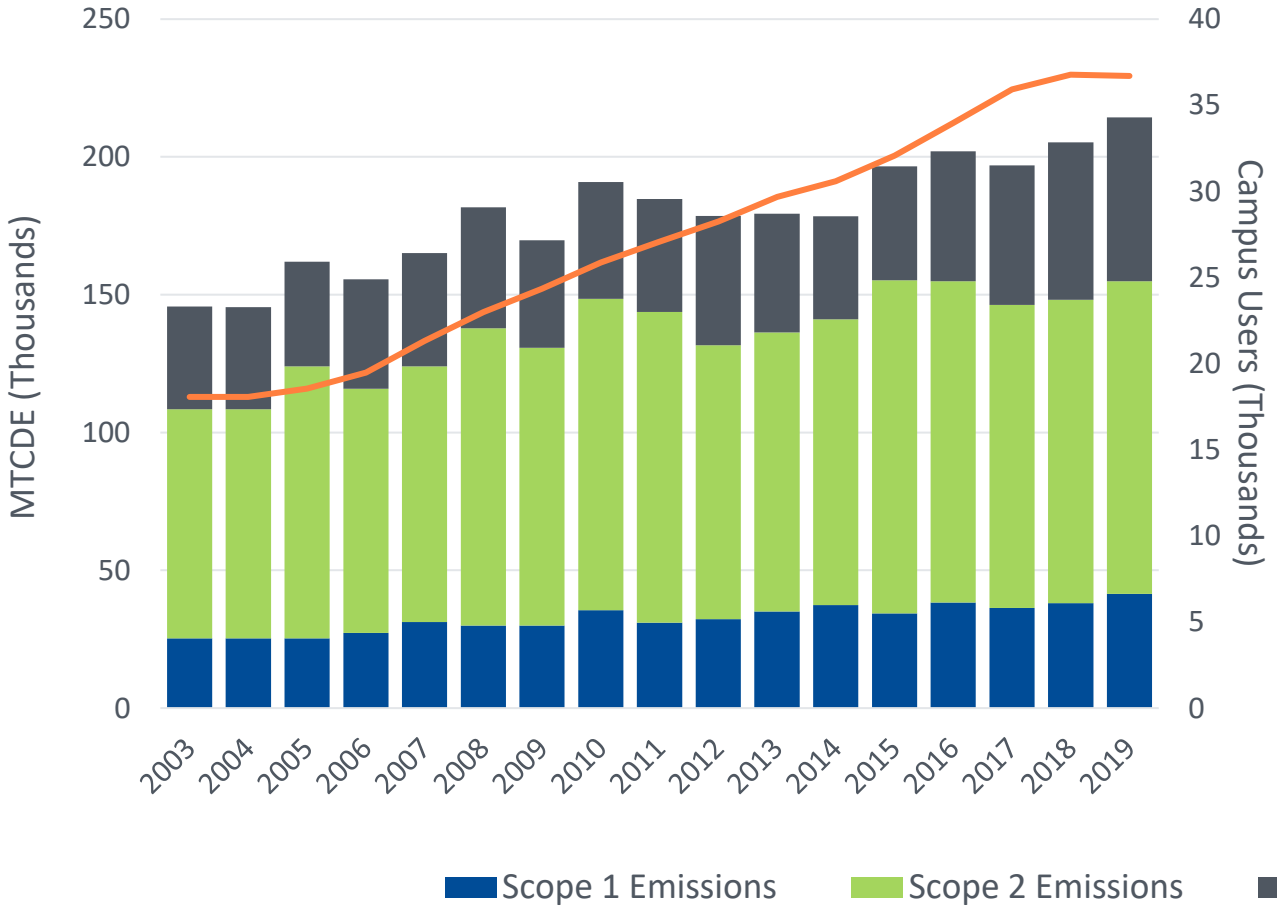


Longitudinal Tracking of Emissions by Scope

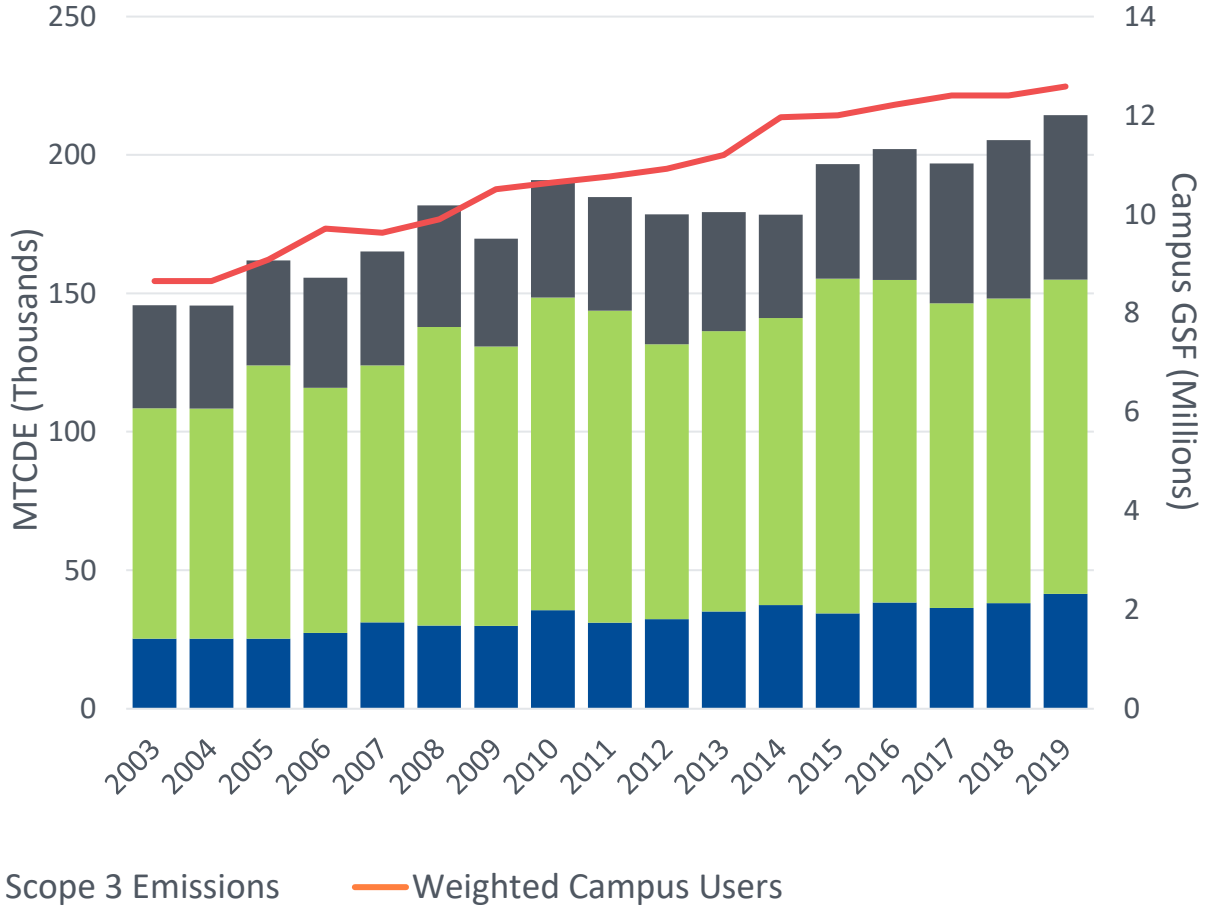
THE UNIVERSITY OF ALABAMA®

Because emissions are based on campus behavior, seeing emissions increase as space and users increase is not surprising

Emissions by Scope Compared to Campus User Growth



Emissions by Scope Compared to Space Growth



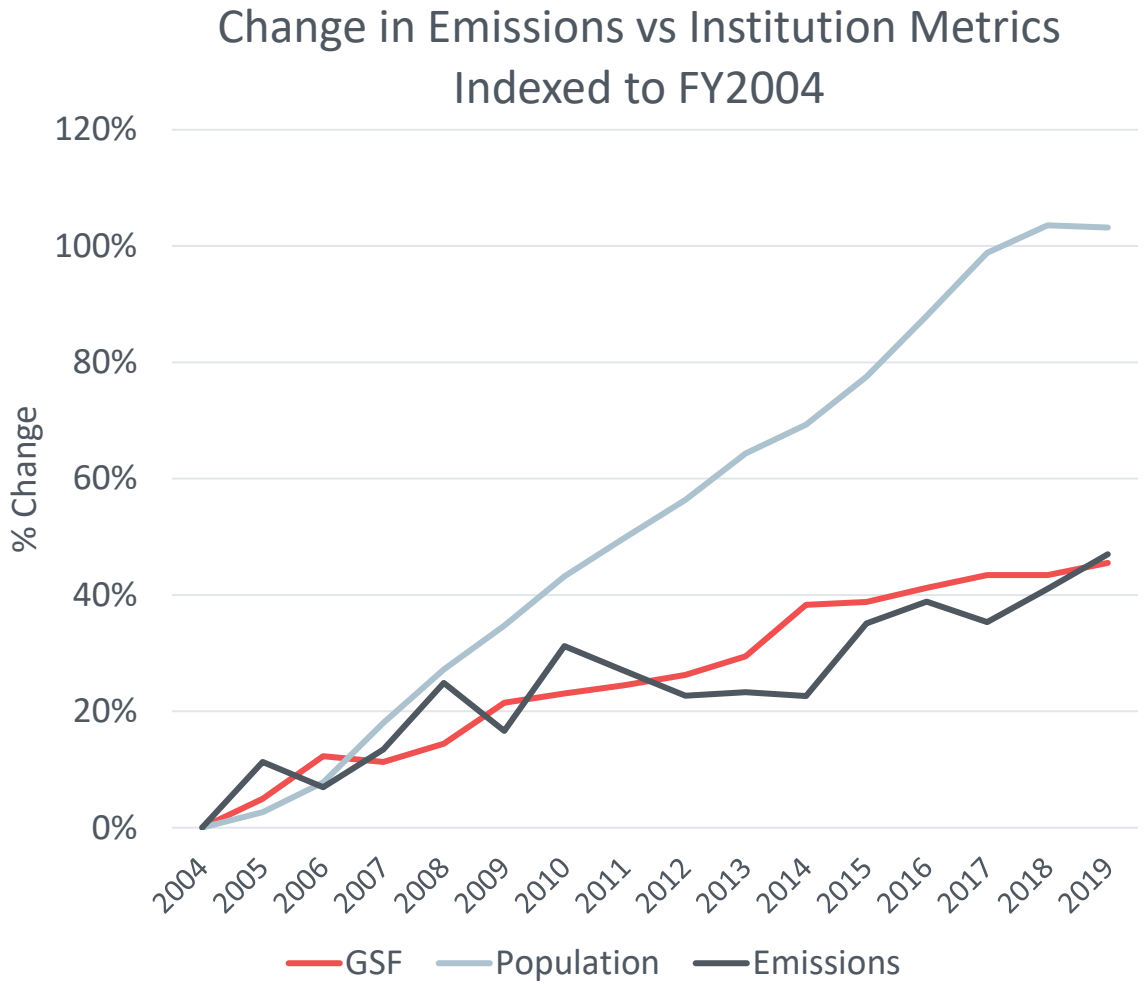
Scope 1 Emissions Scope 2 Emissions Scope 3 Emissions Weighted Campus Users

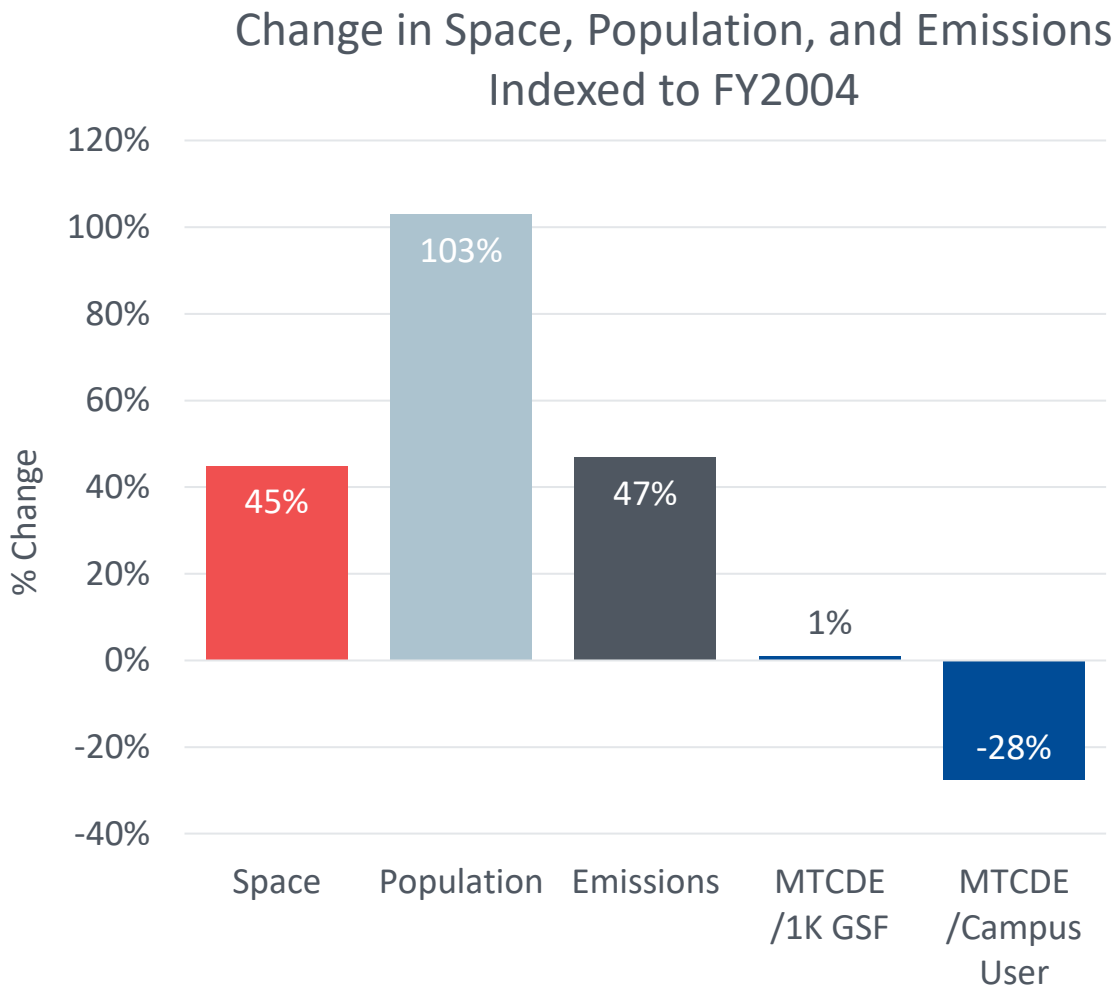
GORDIAN®

Space Highest Driver of Emissions

THE UNIVERSITY OF ALABAMA®

Data suggests campus facilities higher drive of emissions factors than student behavior





GORDIAN®

Alabama Sustainability Initiatives

- *The University of Alabama Energy Policy touches on:*
  - *Energy management strategies*
    - *Temperature control regulations, lighting standards, individual utility behavior standards*
    - *Steam plant standards*
  - *New Construction Design Standards*
    - *ASHRAE Standard No. 90.1 Energy Efficient Design of New Buildings Except Low Rise Residential Buildings*

Mission

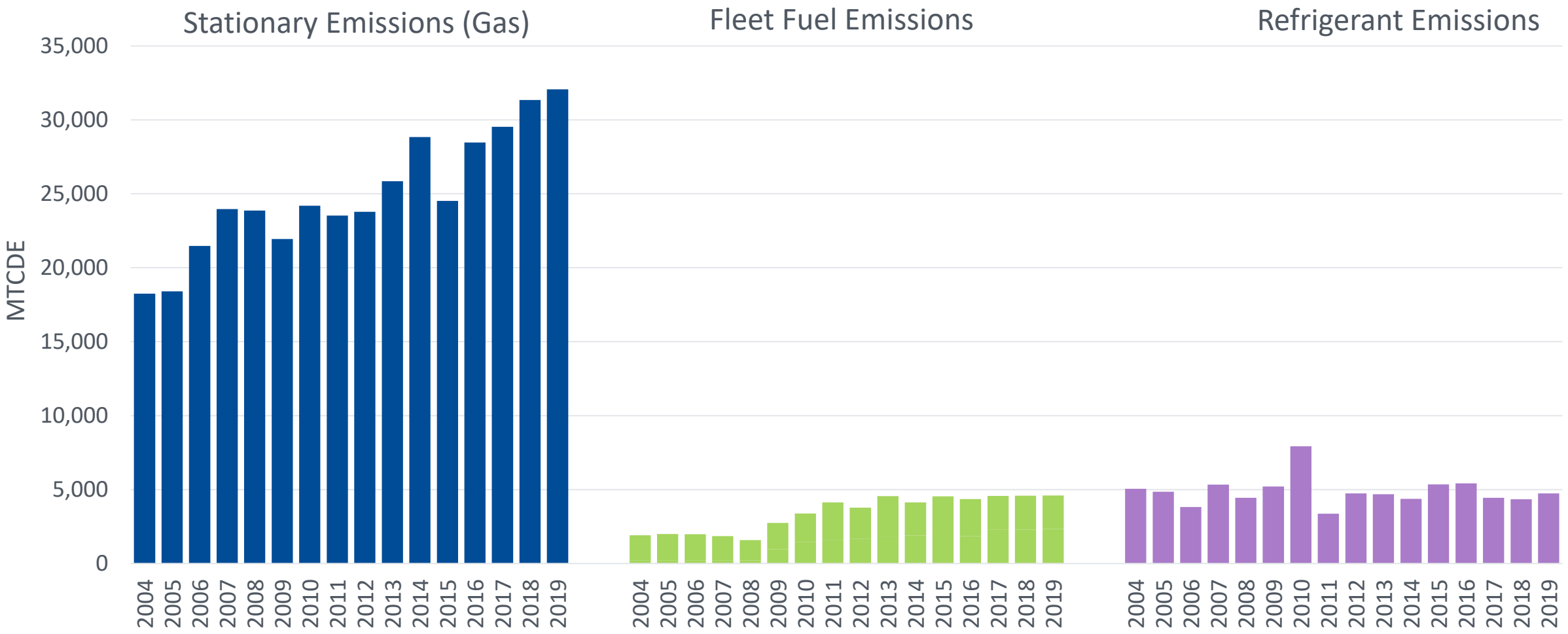
The Office of Sustainability will create a more sustainable tomorrow through research, teaching and promoting green initiatives and services within the University and surrounding communities. We will focus on the importance of recycling, reducing consumption, educating others on the importance of sustainability and providing sustainable solutions while being more aware of our environment in our local community as well as regionally, nationally and globally.

https://fa-webprod.fa.ua.edu/UAFASPOnlinePublic/804c2645-66d2-4035-87fe-4f4c0e88f646/Energy%20Policy.pdf

Scope 1 Emissions: Natural Gas

Scope 1 Emissions By Source

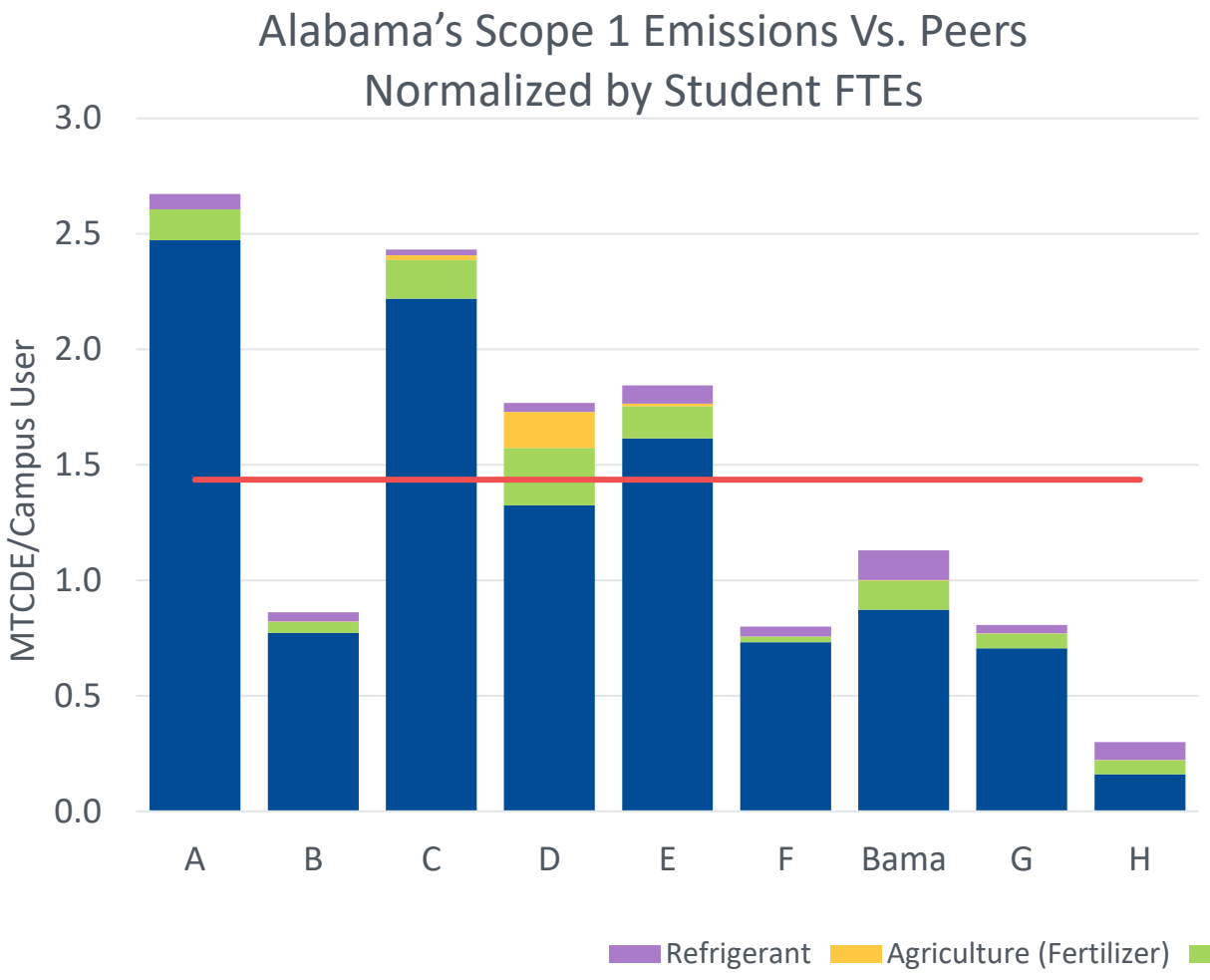
Majority of Scope 1 emissions from Natural Gas consumption

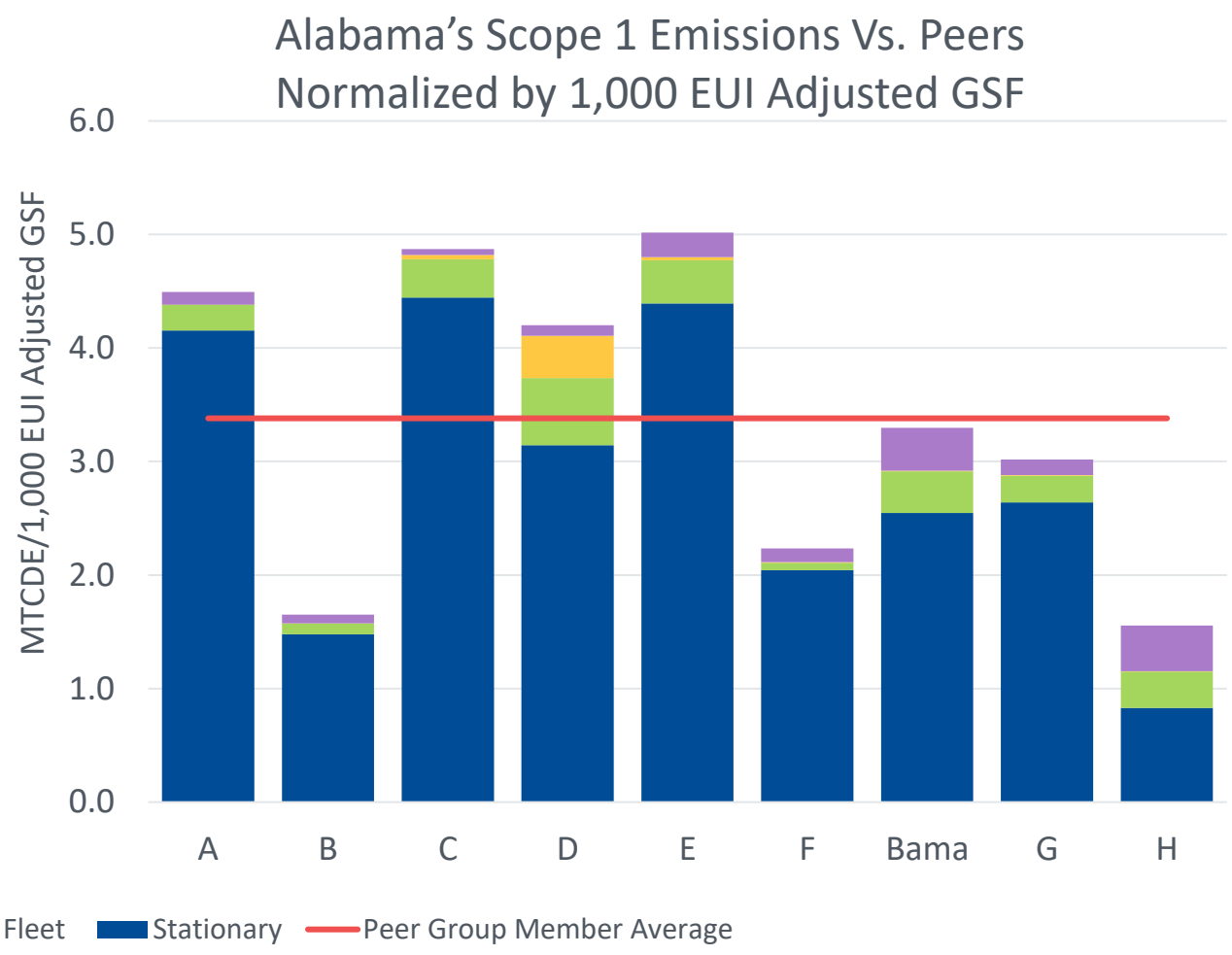


**fertilizer left out: insignificant factor for emissions*

Scope 1 Emissions by Source, Normalized

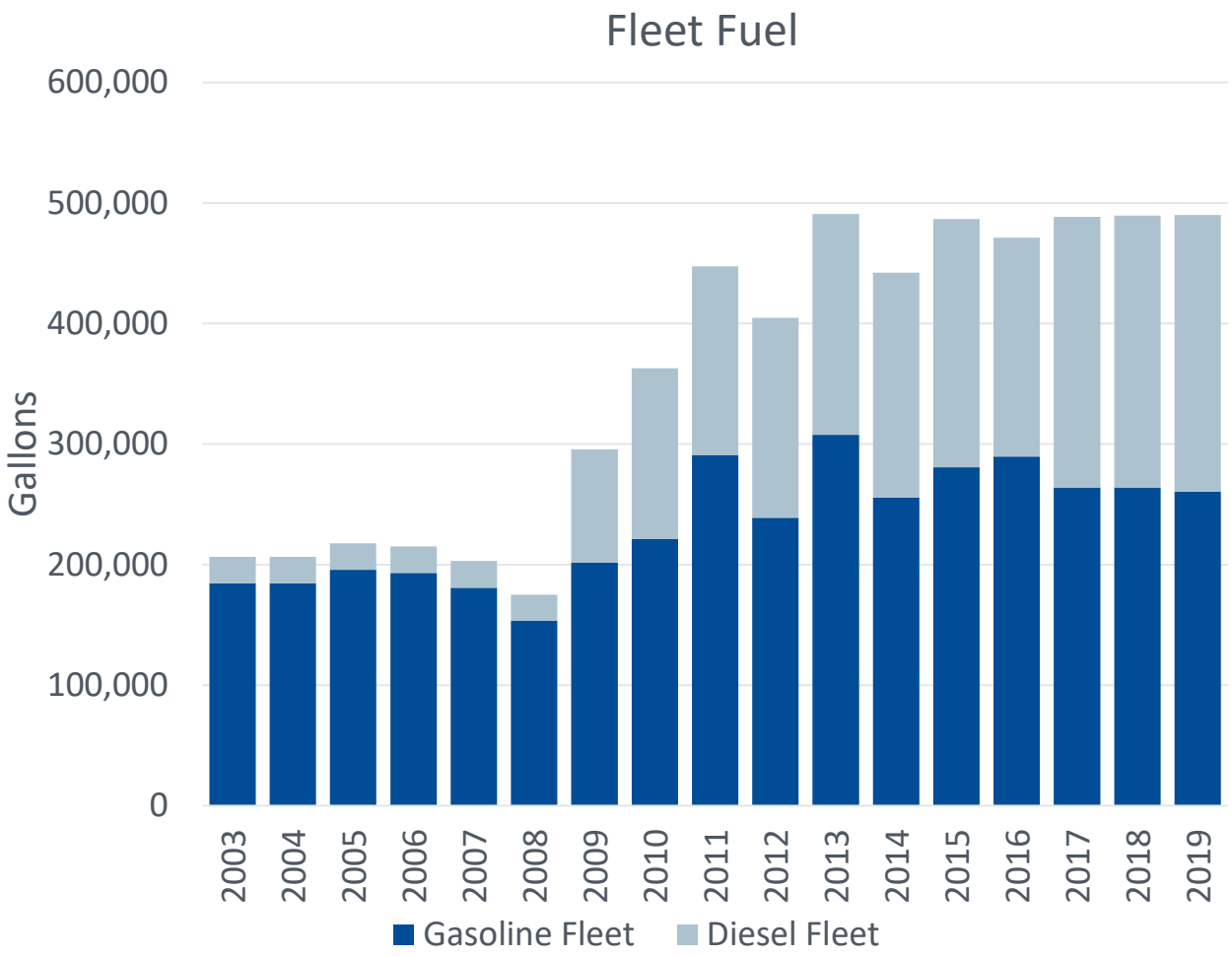
Alabama operating below peer average





Fleet Fuel – Additional Scope 1 Sources

Fleet Fuel emissions are 11% of total scope 1 emissions in FY19



UNIVERSITY OF ALABAMA HOPES TO ATTRACT MORE ELECTRIC CARS WITH CHARGING STATIONS

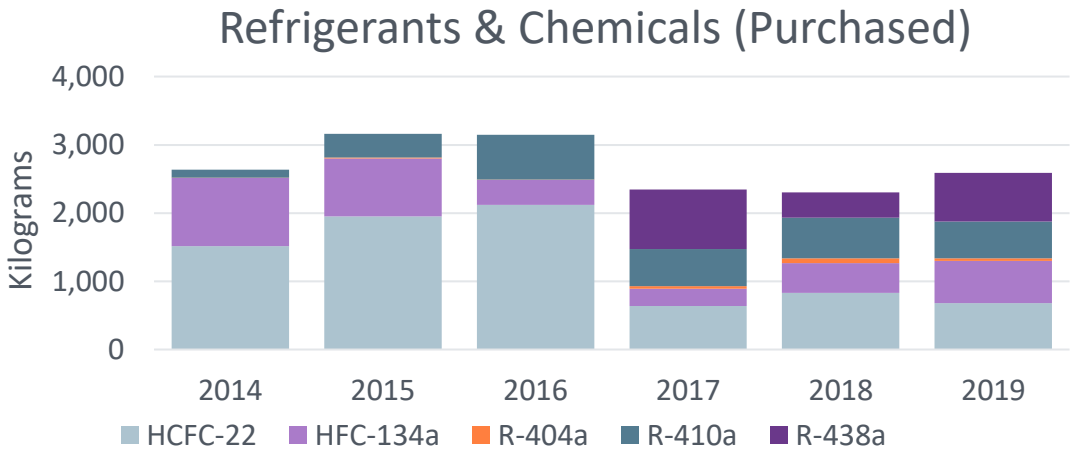
"We're always looking into different ways that we can save money, save energy on campus and we typically meet with our Alabama Power rep every two or three months to go over different ideas," Grill said. "He brought up the fact that there was an Alabama grant to help purchase and install electrical vehicle charging stations at different locations throughout the state."

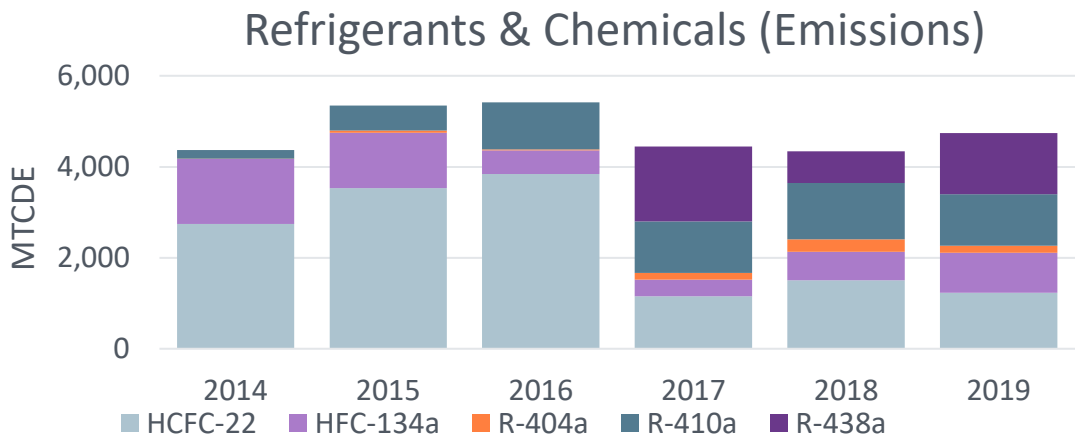
With the additional seven EVSE stations, Alabama is among the SEC schools with the most charging stations. Only Tennessee, Texas A&M and Auburn have more, according to school websites and chargehub.com. However, it is unclear how many charging ports are at each of these stations. The University of California at Davis paces the nation in charging stations with 38.

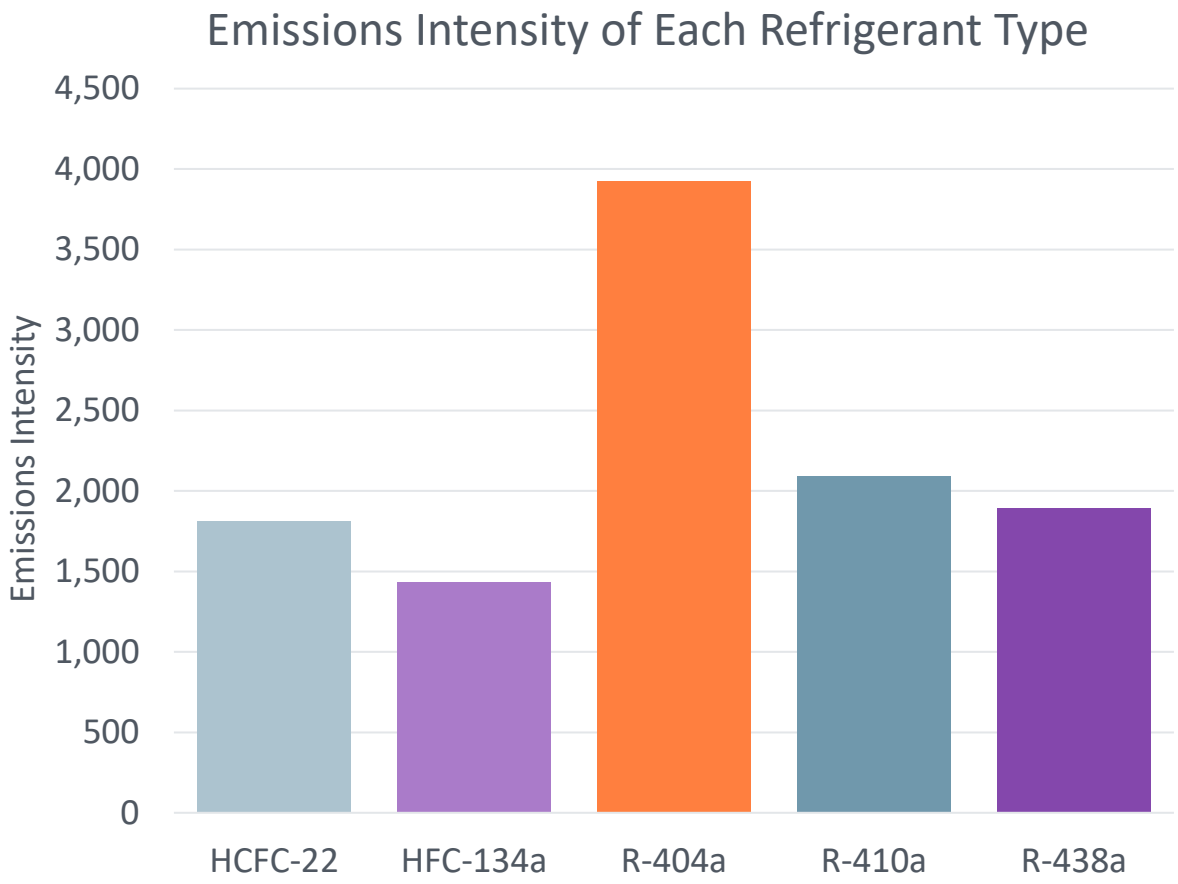
https://wvua23.com/university-of-alabama-hopes-to-attract-more-electric-cars-with-charging-stations/

Refrigerant & Their Emissions Factors

Refrigerants down from FY15 & FY16



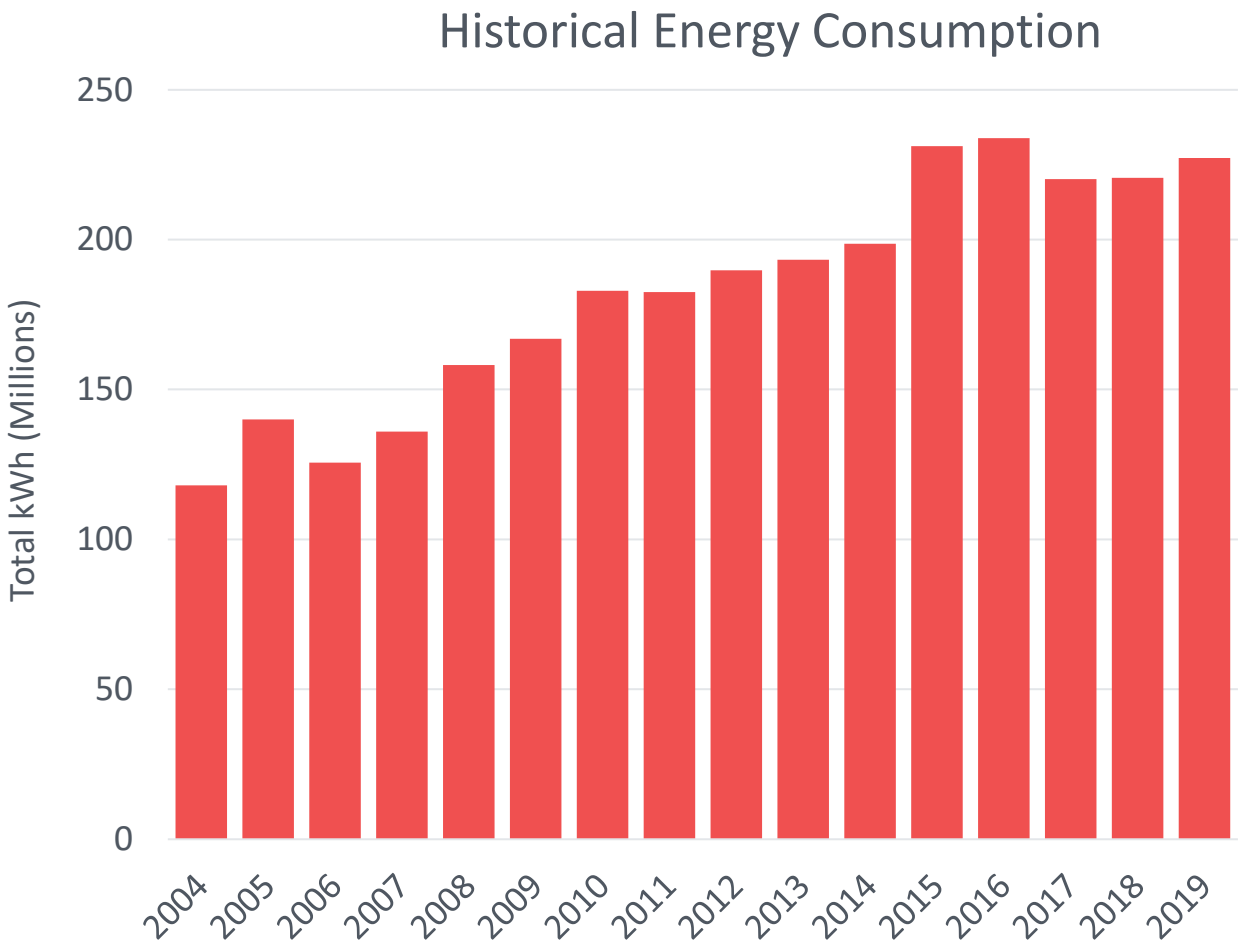


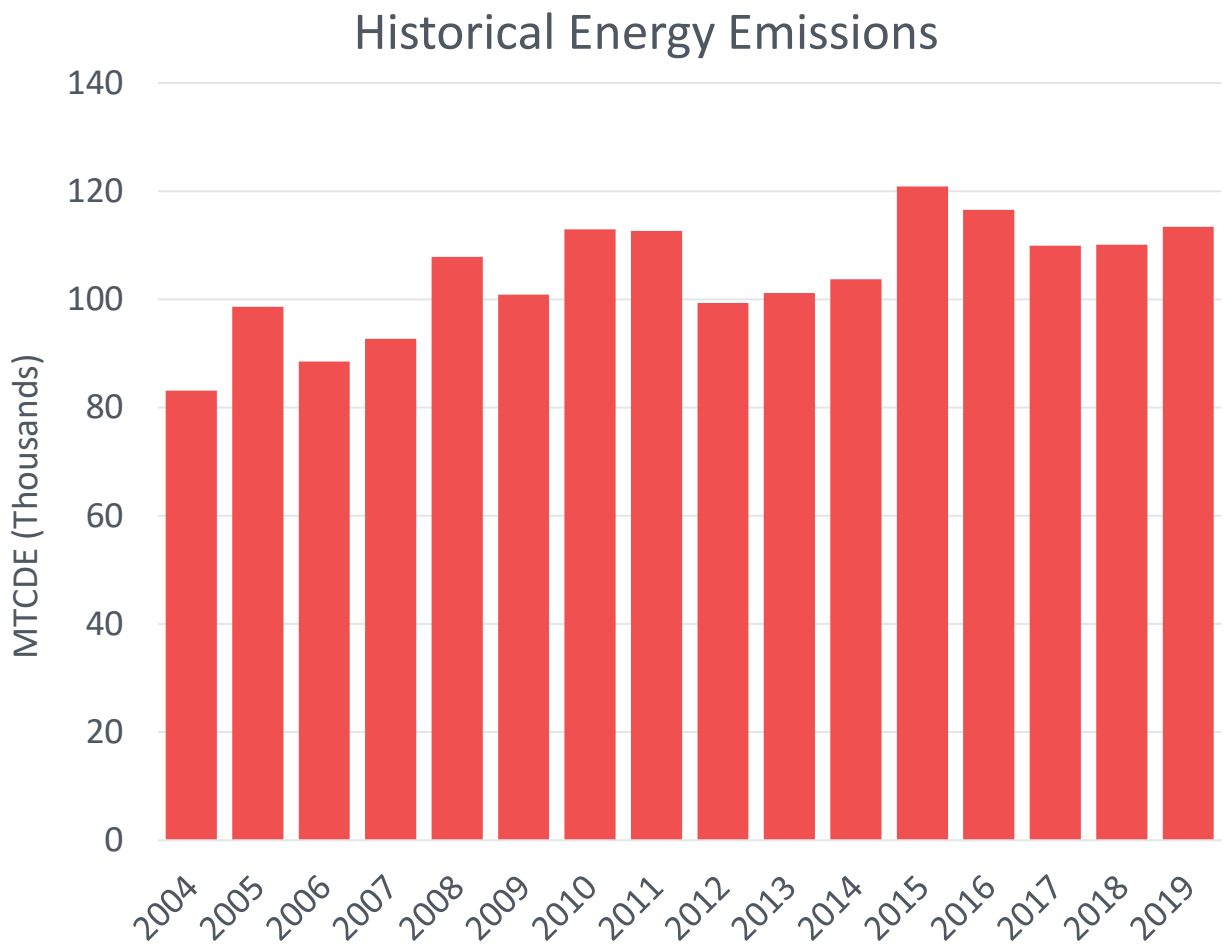


Scope 2 Emissions: Purchased Electricity

Scope 2: Electricity Consumption vs Emissions

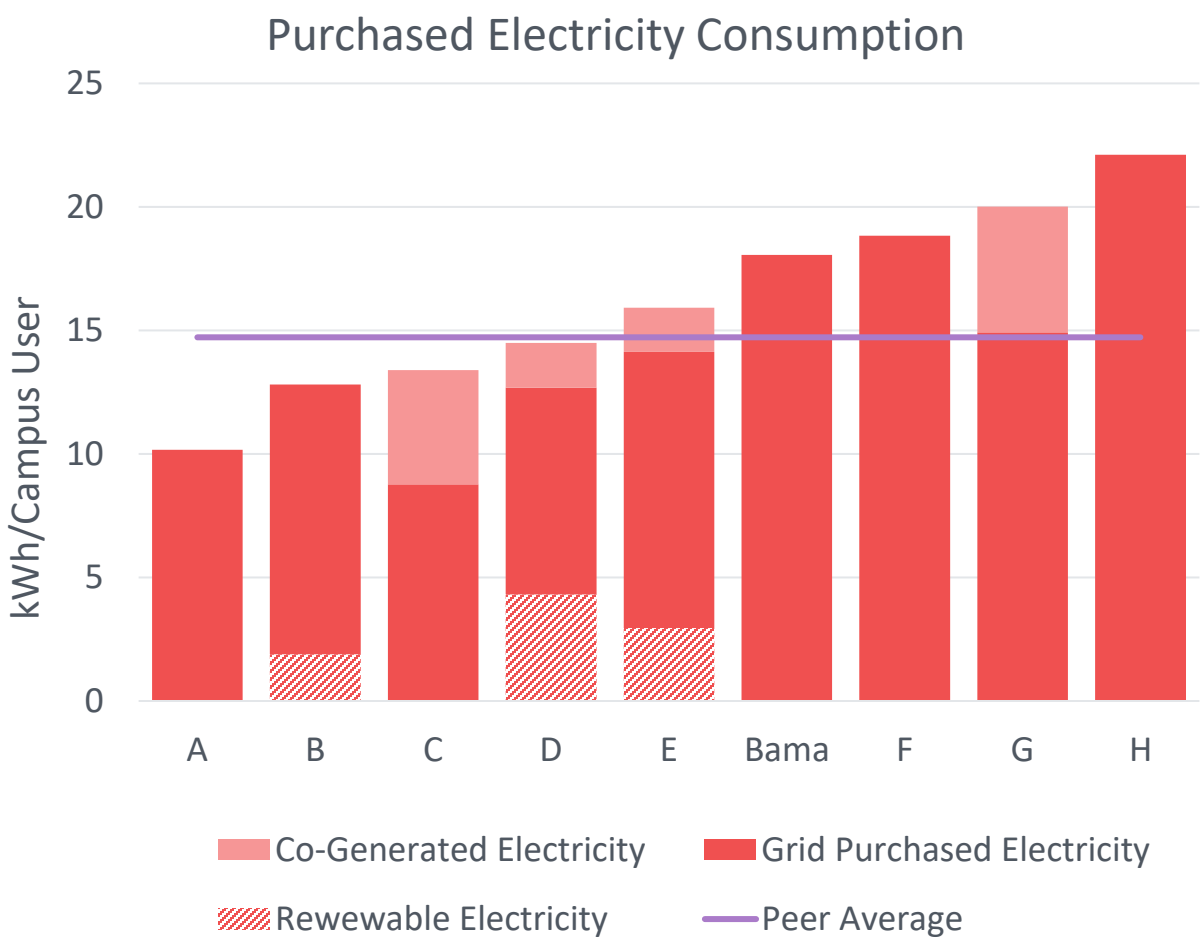
Electricity consumption rose slightly in FY19, remains steady

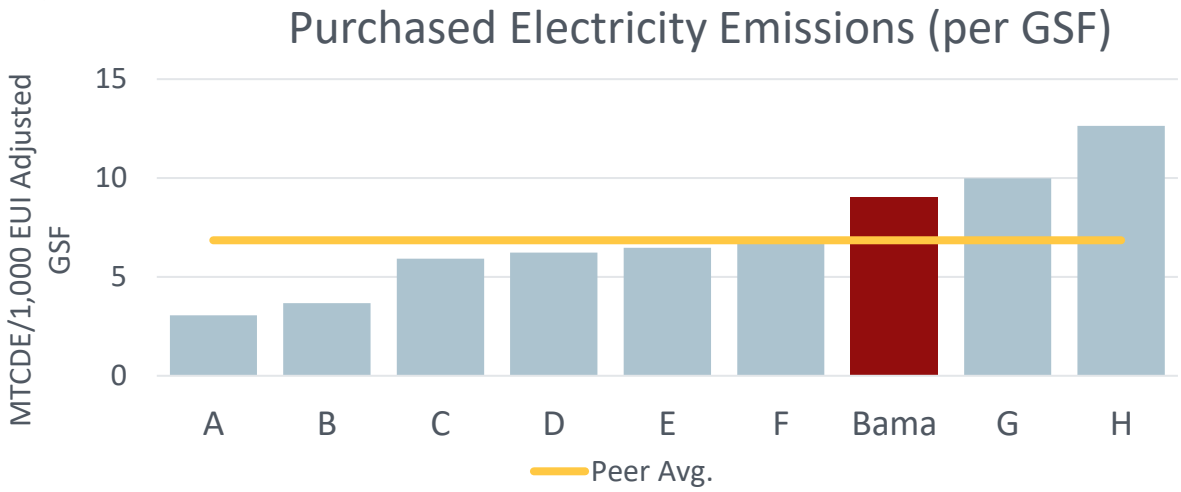


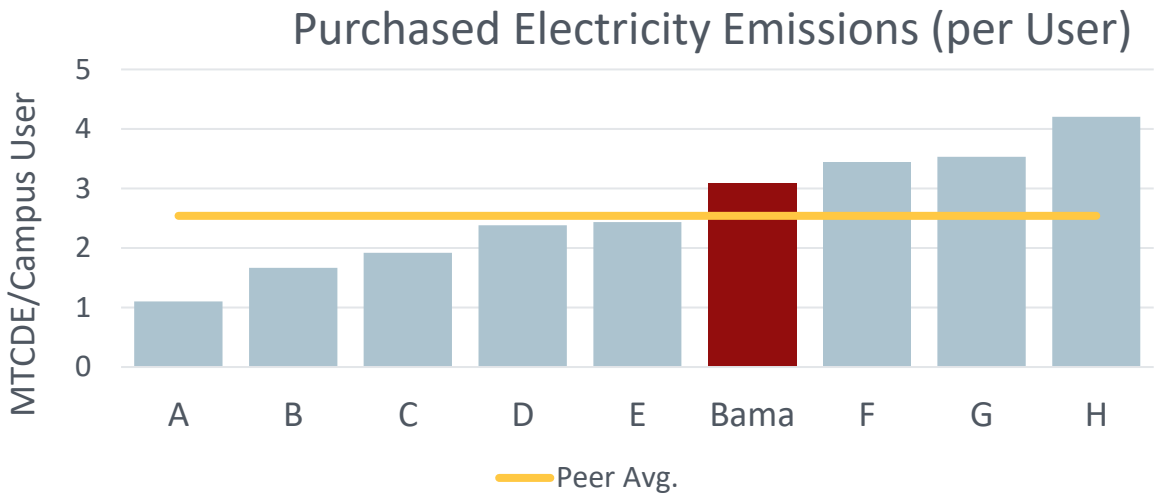


Comparing Emissions from Electricity

Type of electricity consumed impacts emissions







** Co-Generated Electricity and Renewable Energy do not contribute to emissions*

What's Next for Scope 2?

THE UNIVERSITY OF ALABAMA®

"To create a more sustainable tomorrow through research, teaching and promoting green initiatives and services within the University and surrounding communities."

Strategy at Alabama:

- *New Construction Design Standards*
- *Energy management strategies*

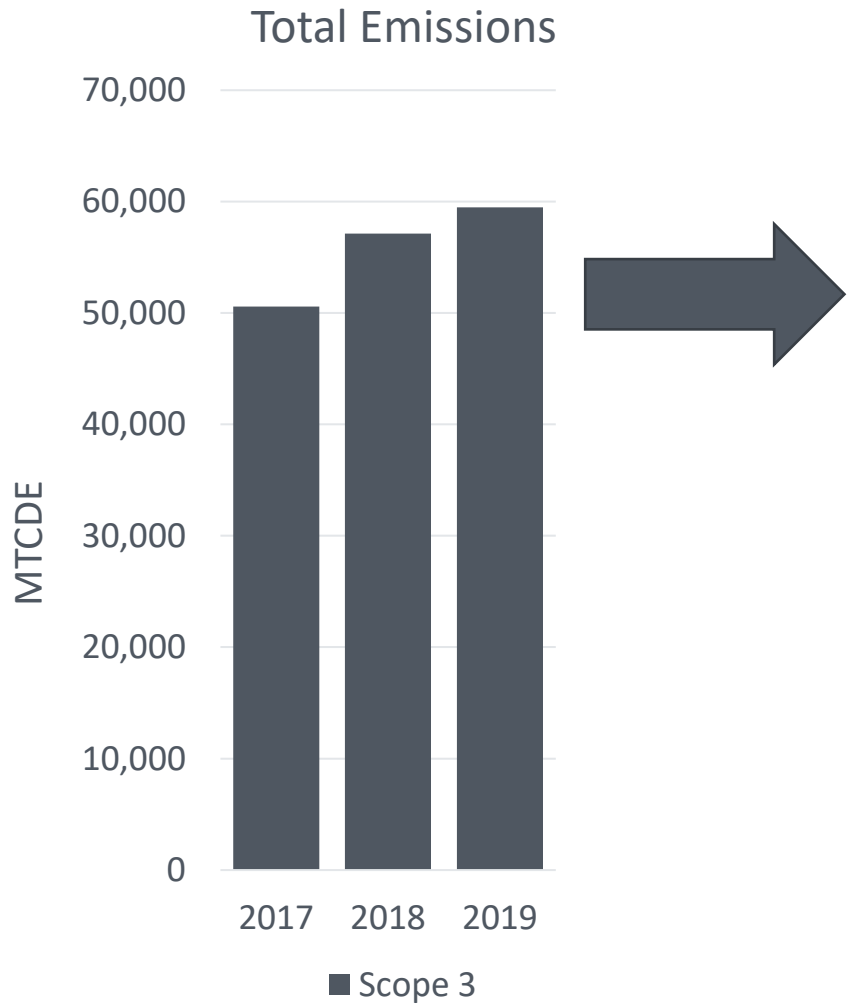
Can we create tangible electricity consumption goals?
Do we want to become the most energy efficient school of our peers on a consumption/GSF or consumption/FTE basis?

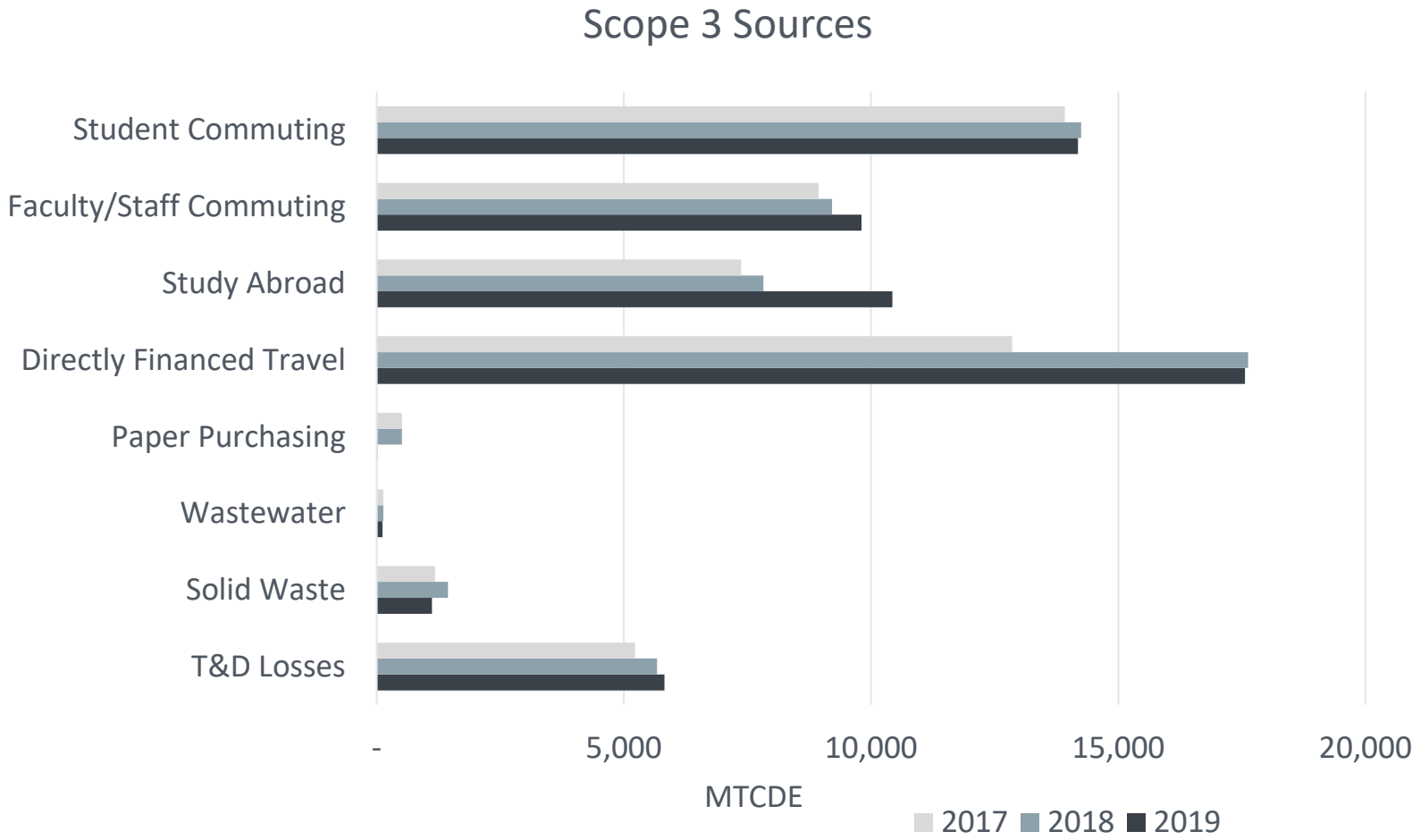
GORDIAN®

Scope 3 Emissions

Scope 3 Distribution by Source

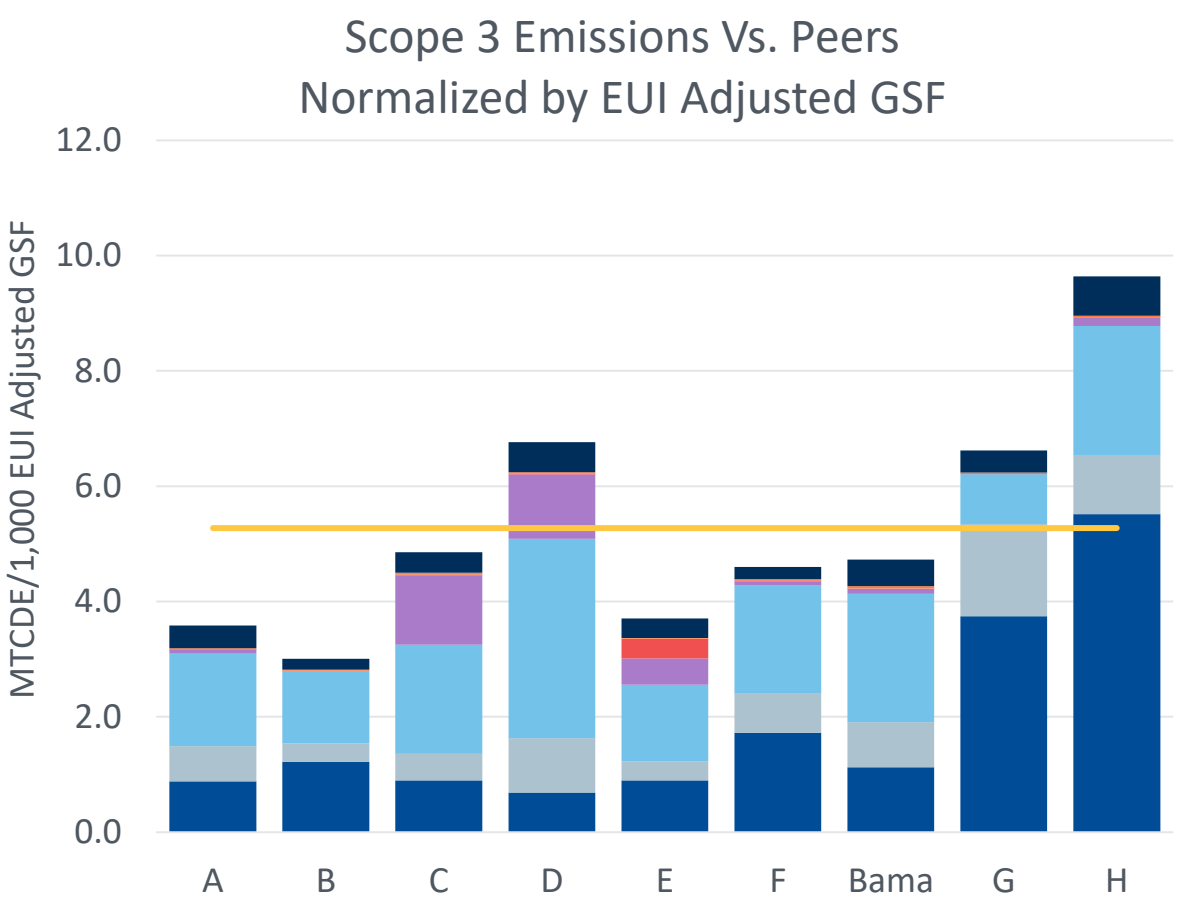
Study abroad and faculty/staff commuting showed biggest increases in FY19

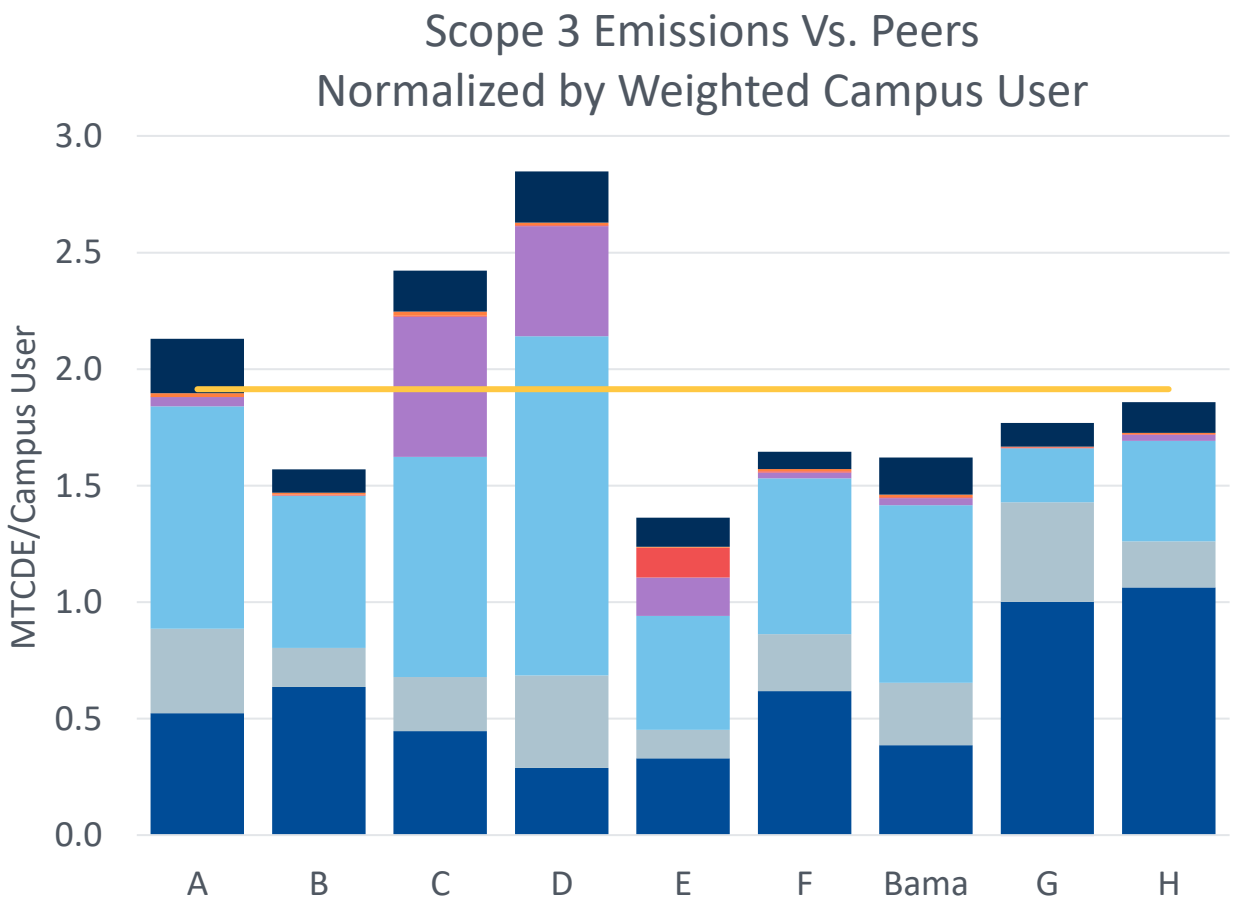




Scope 3 – Emissions by Source

Scope 3 at Alabama driven by travel





T&D Losses | Paper Emissions | Wastewater Emissions | Waste Emissions | Other Travel Emissions | Employee Commuting | Student Commuiting | Peer Average

Scope 3 Emissions Increasing Over Time

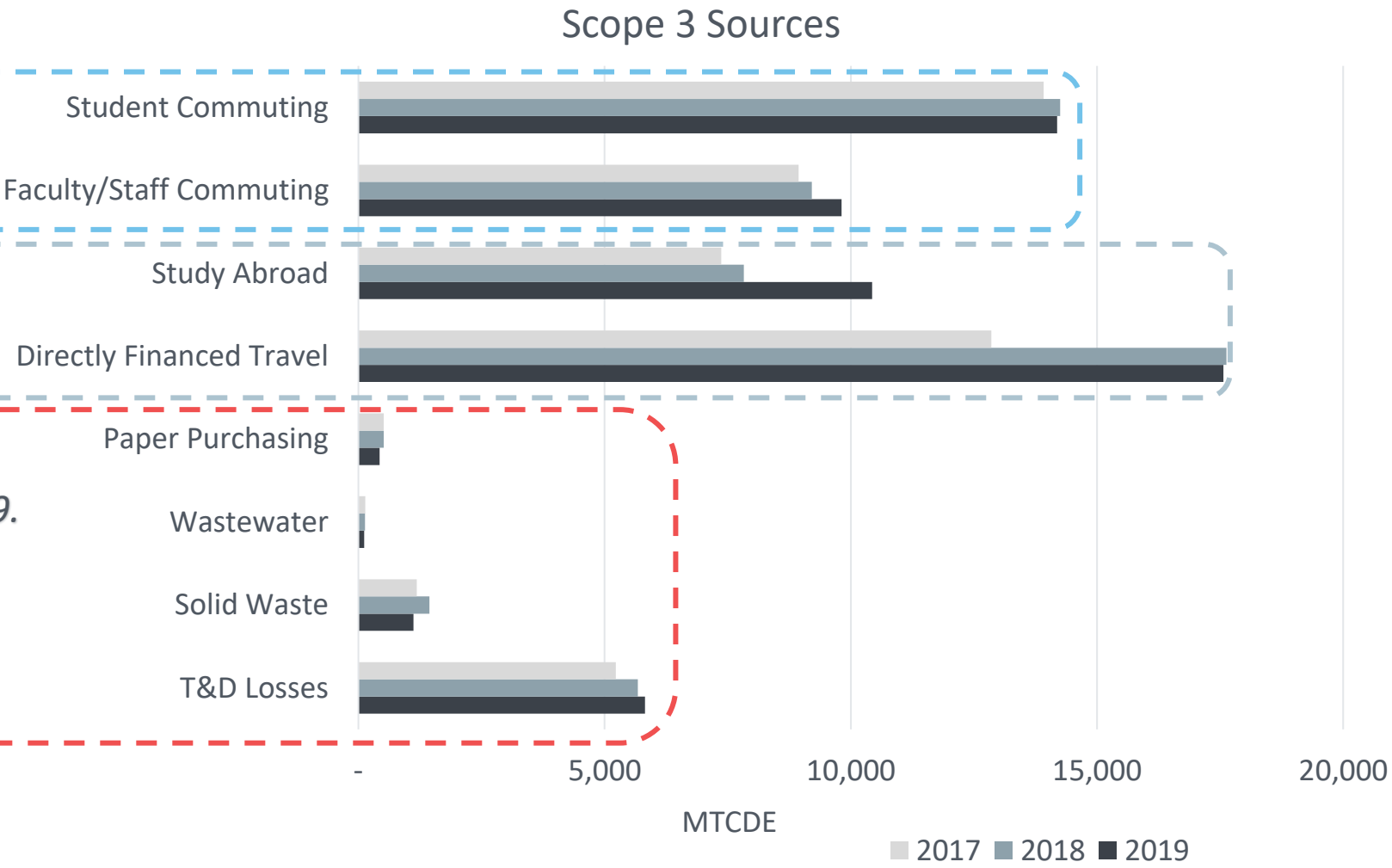
THE UNIVERSITY OF ALABAMA®

Travel and Commuting Emissions are the largest contributors to Scope 3

***Commuting** accounted for **40%** of all Scope 3 Emissions in FY19.*

***Travel** accounted for **47%** of all Scope 3 Emissions in FY19.*

***Other Scope 3** made up the remaining **13%** of emissions in FY19.*

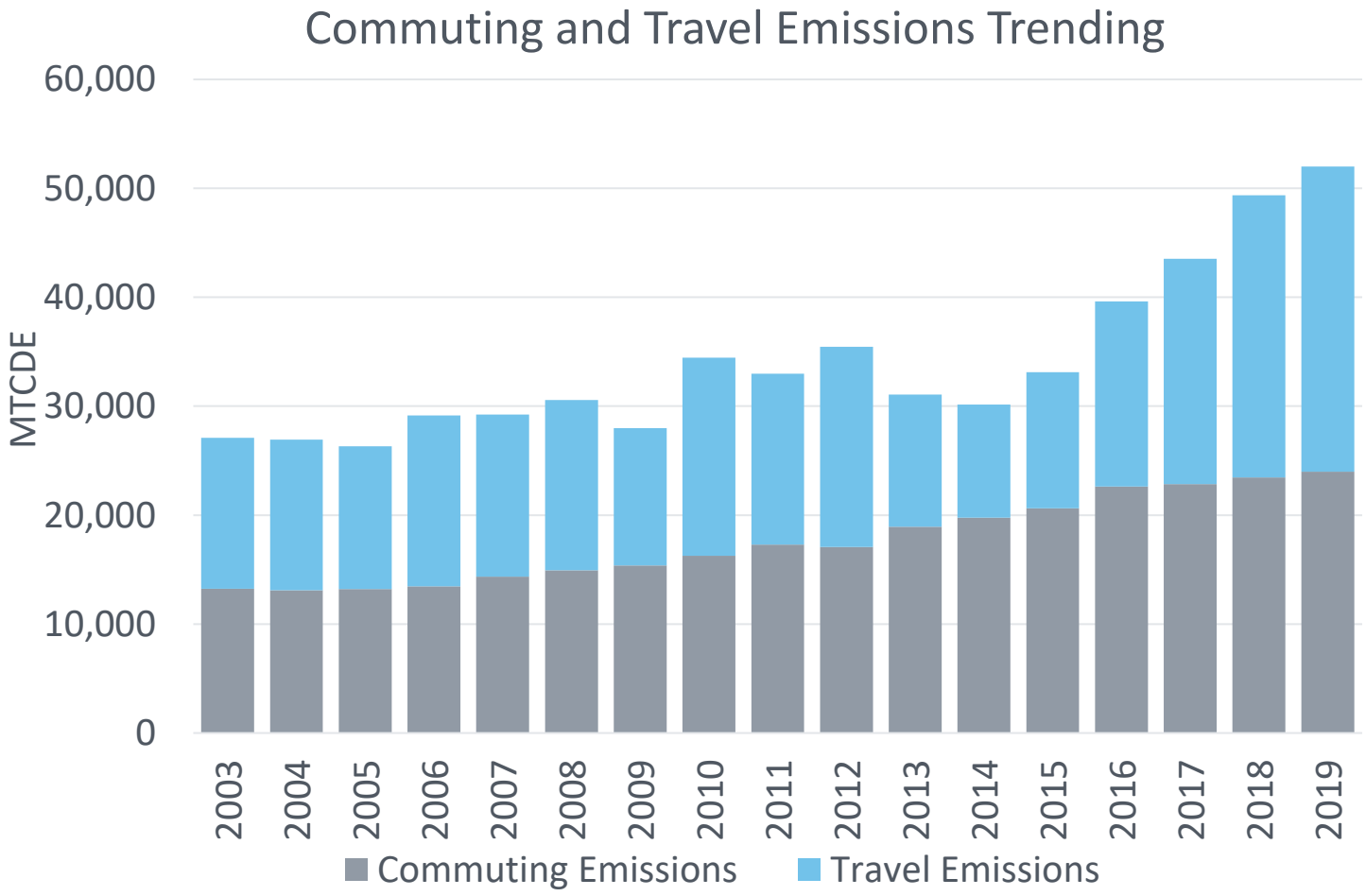


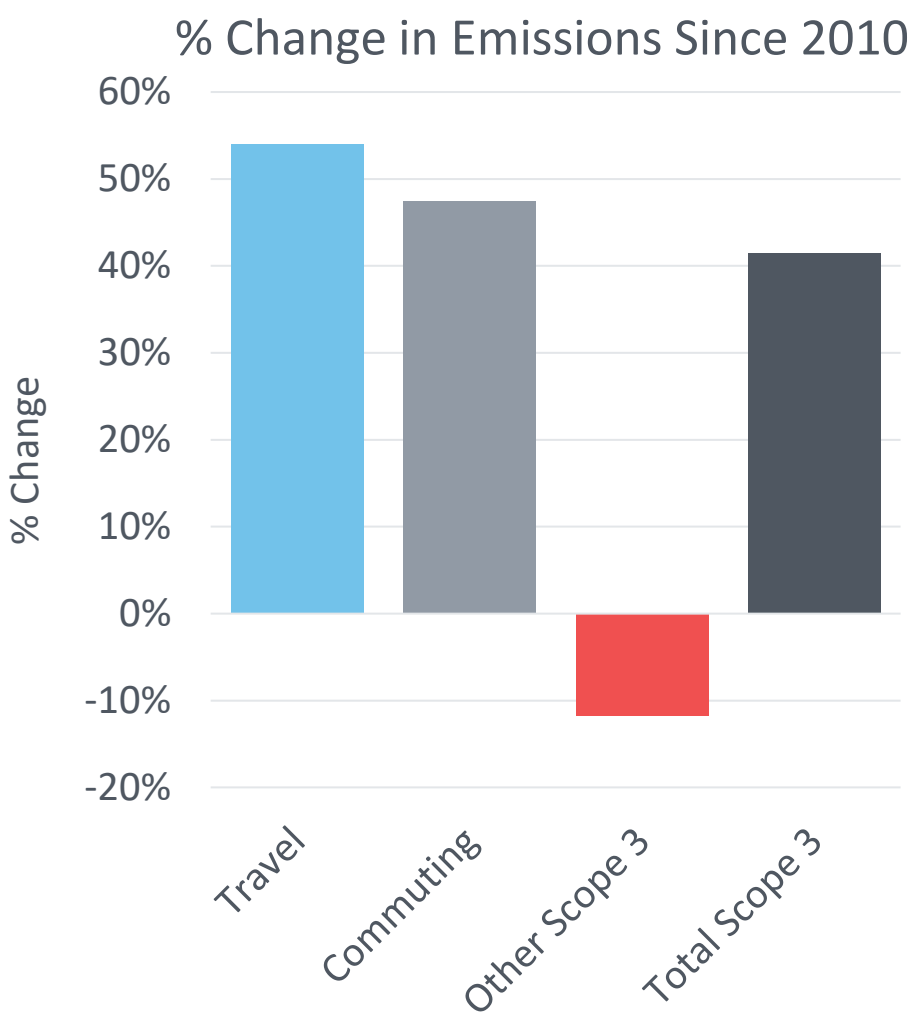
GORDIAN®

Scope 3 Emissions Increasing Over Time

THE UNIVERSITY OF ALABAMA®

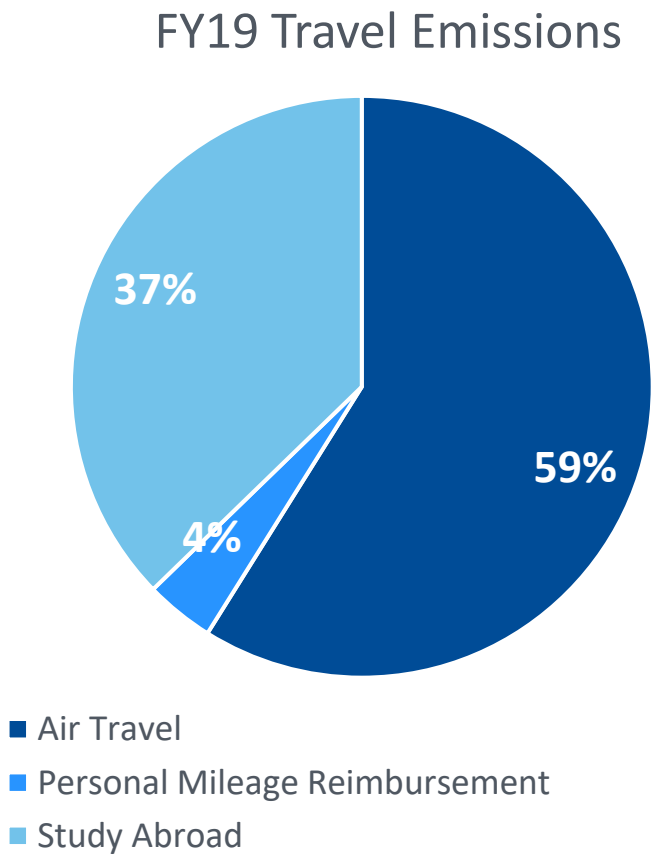
The increase in commuting and travel emissions was the primary driver for increase in Scope 3 since 2010





Emissions Increasing Over Time

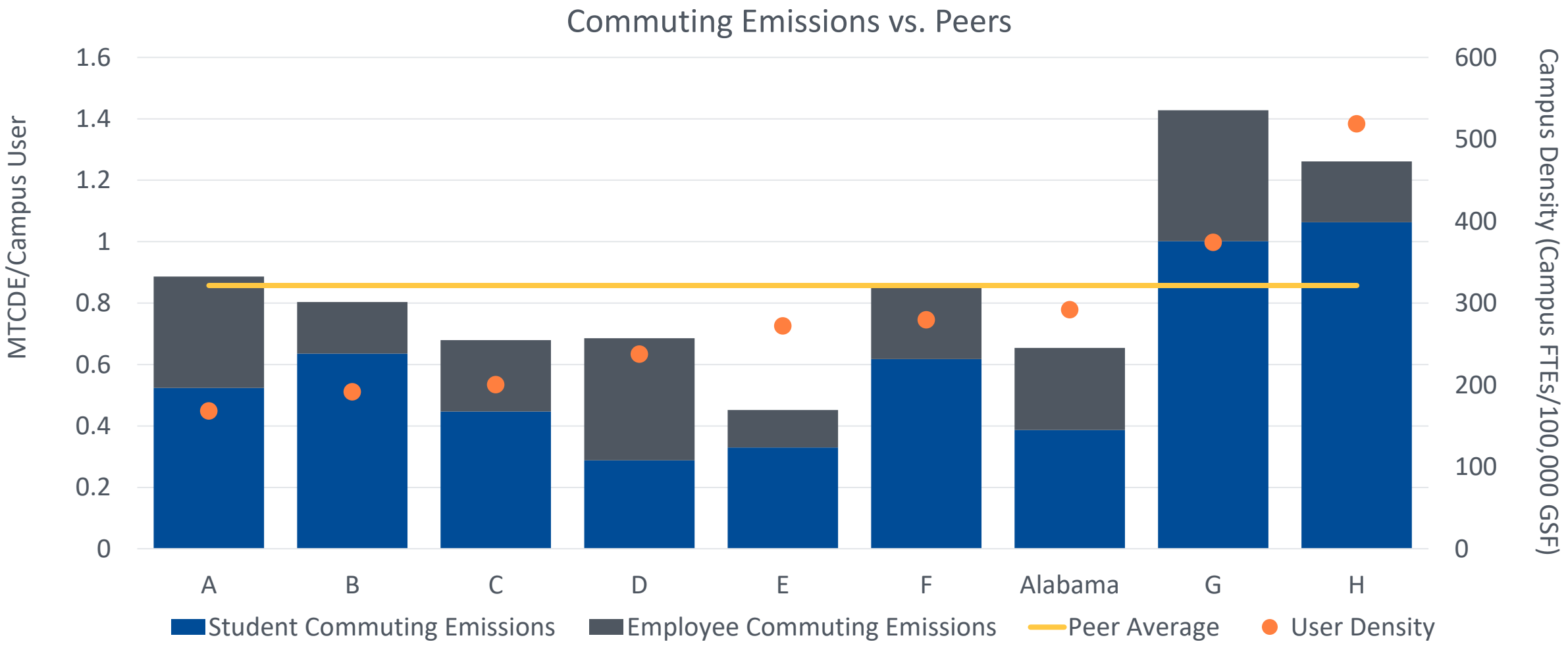
Travel emissions have increased 51% over the last decade, increase in air travel drives change



Commuting Emissions Compared to Peers

THE UNIVERSITY OF ALABAMA®

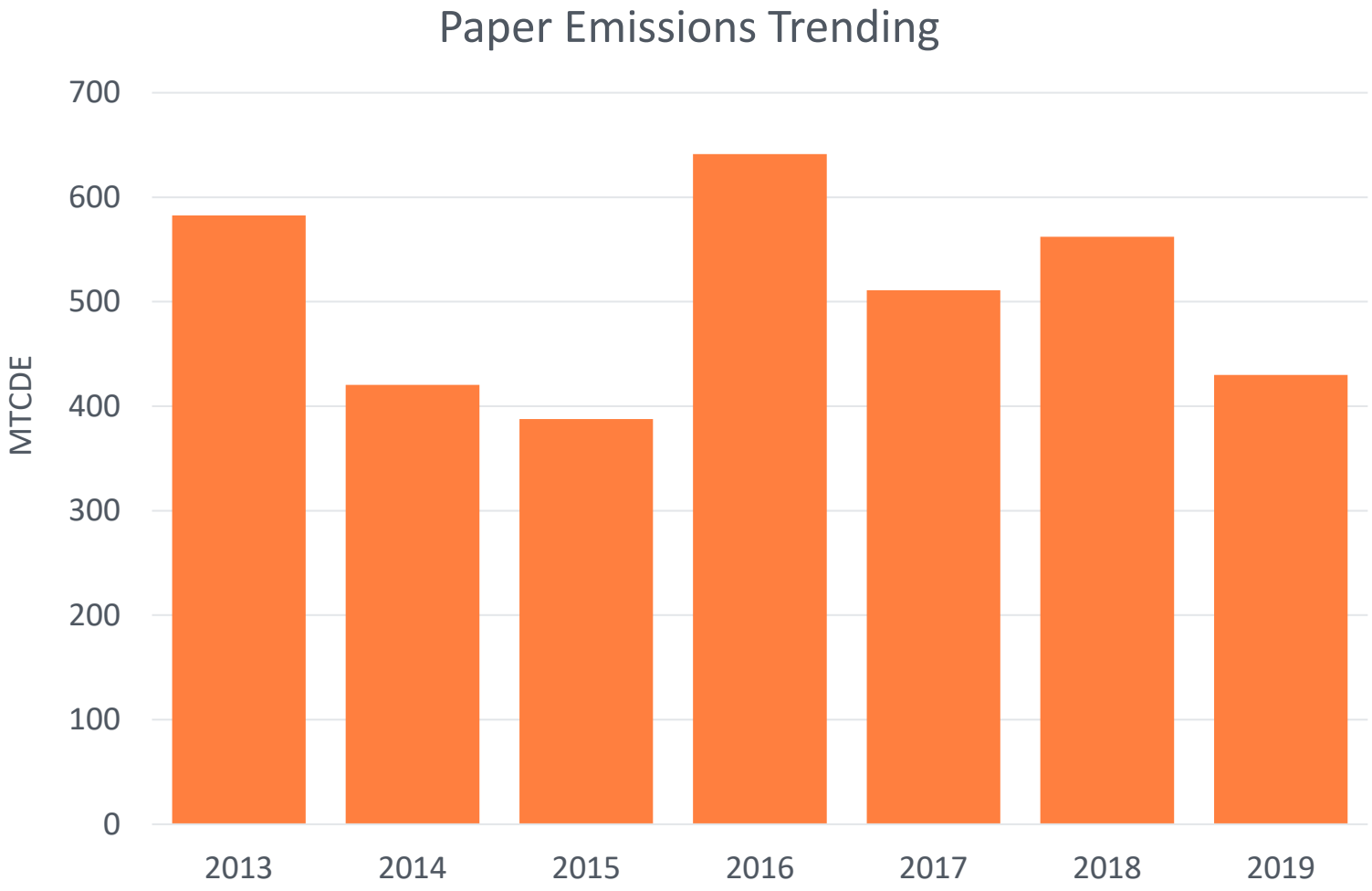
When would be the best time to administer a commuting survey to update commuting assumptions

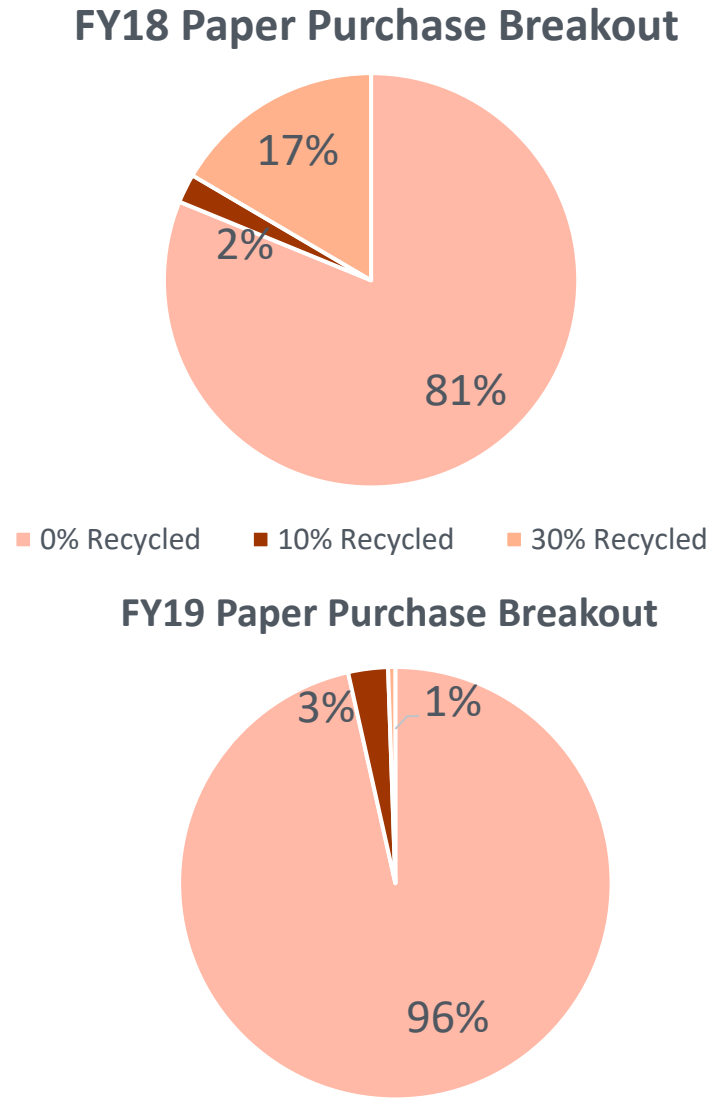


GORDIAN®

Paper Purchasing and Emissions

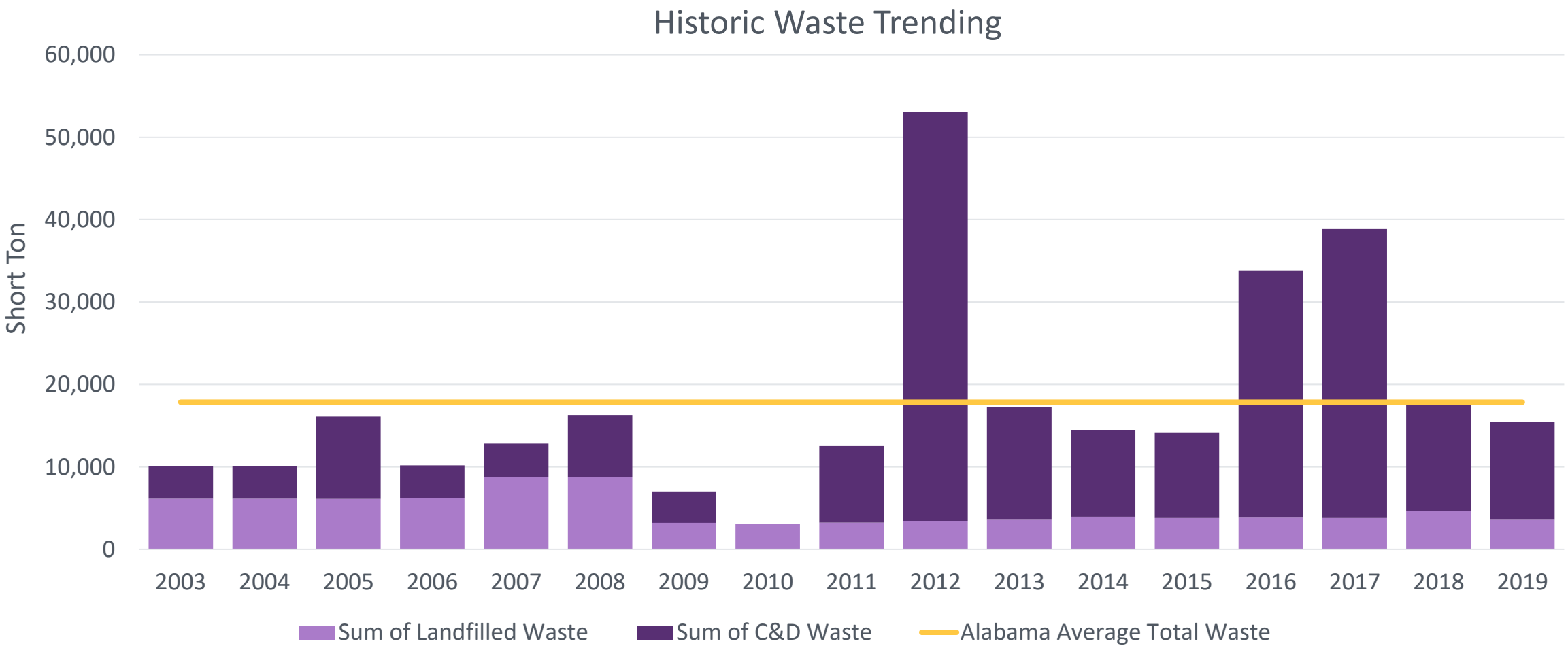
Alabama used less overall paper in FY19 but less recycled paper





Measuring Campus Waste

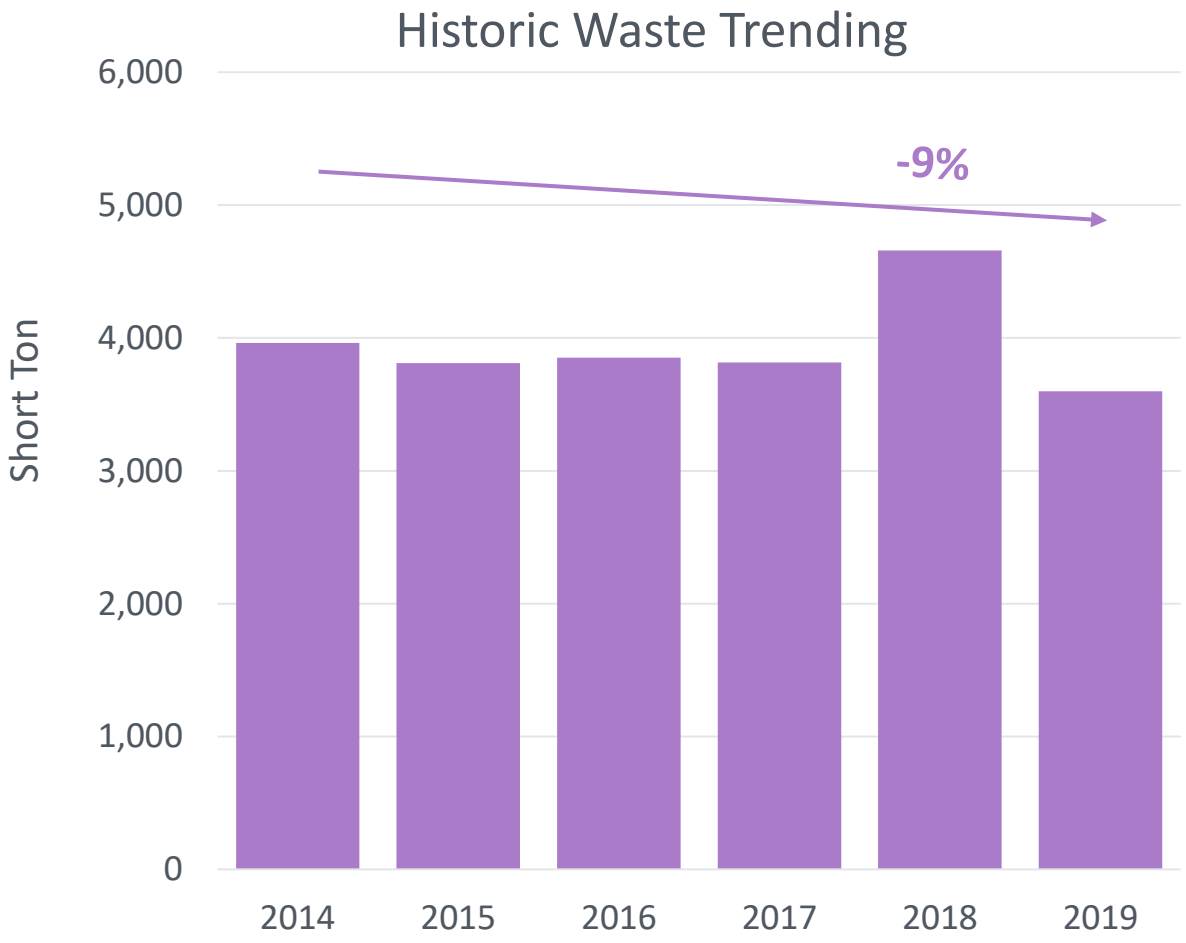
C&D is most of the waste on campus, less C&D waste and less landfilled waste led to reduction in FY19

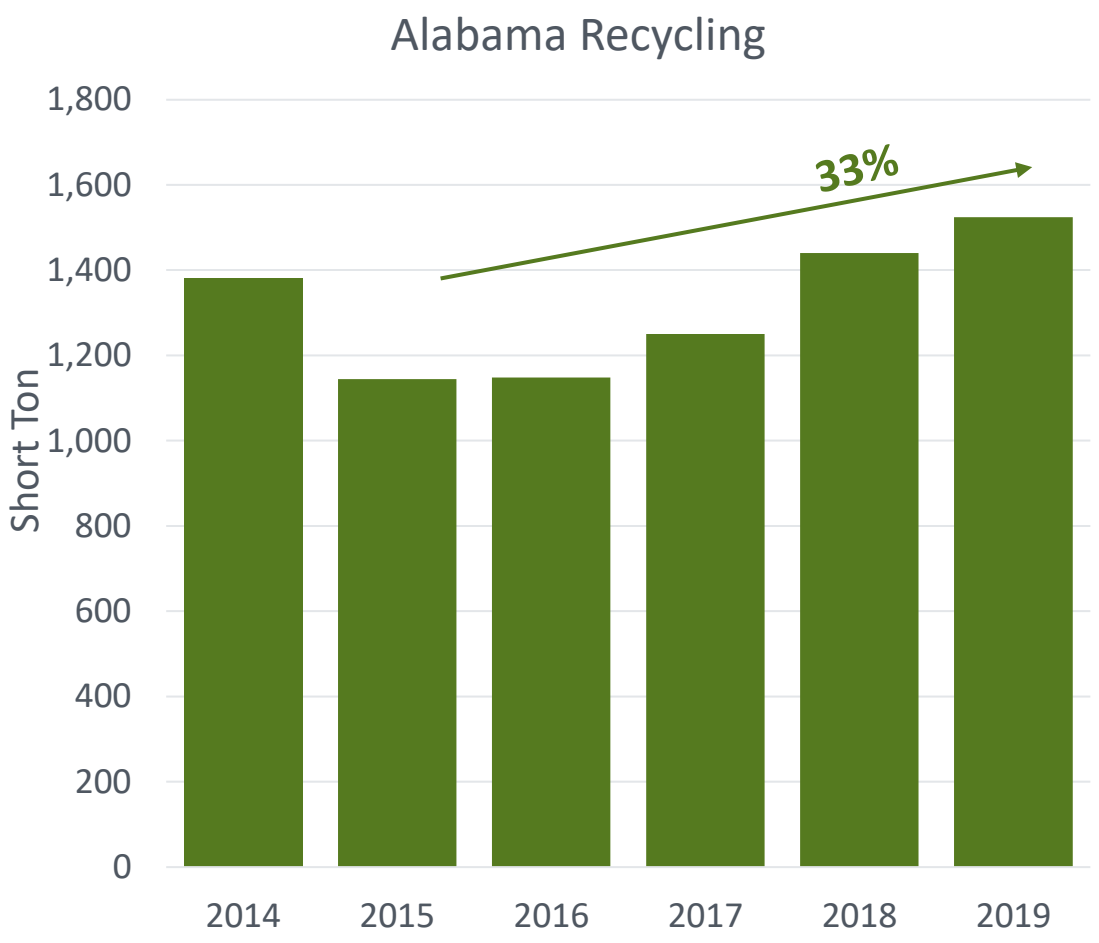


Measuring Campus Waste

THE UNIVERSITY OF ALABAMA®

Since 2014, recycling has been increasing and landfilled waste has been decreasing



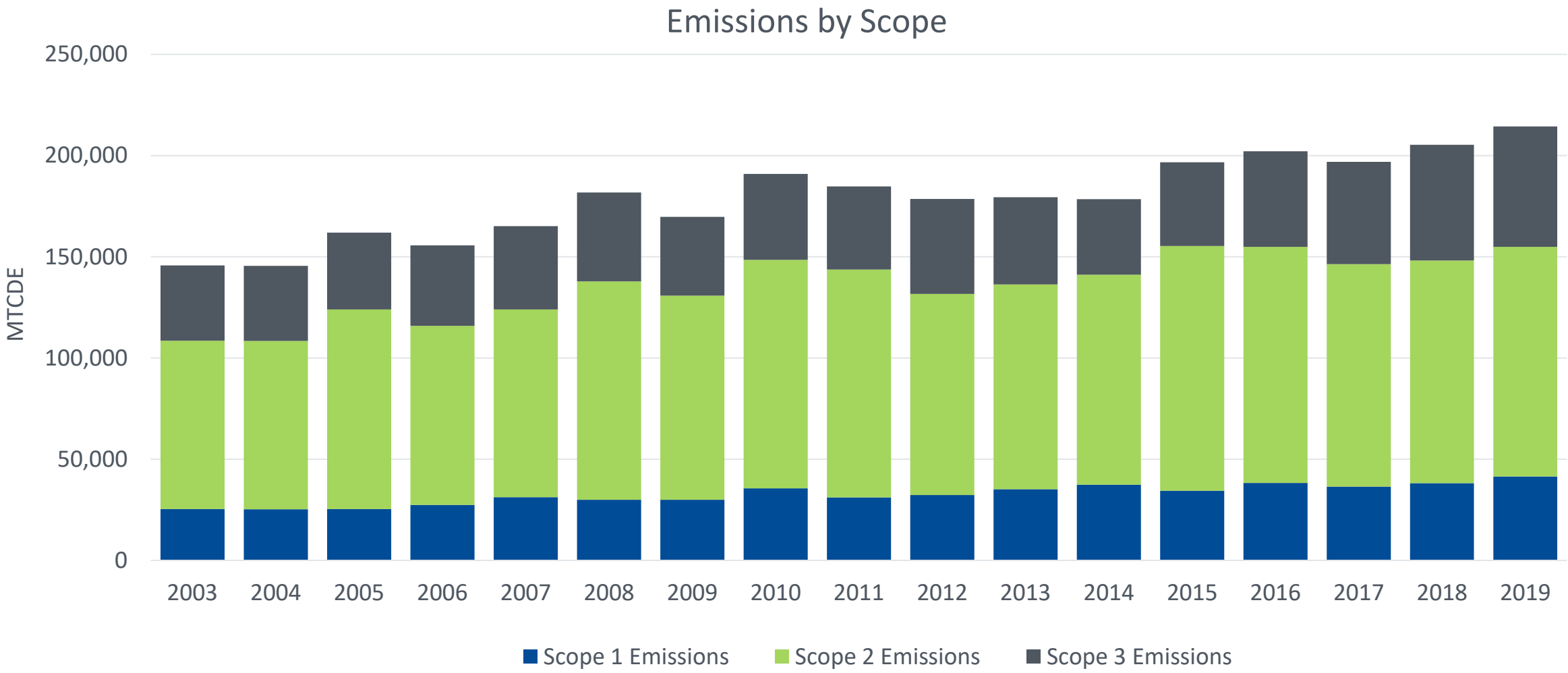


GORDIAN®

Total Emissions Profile

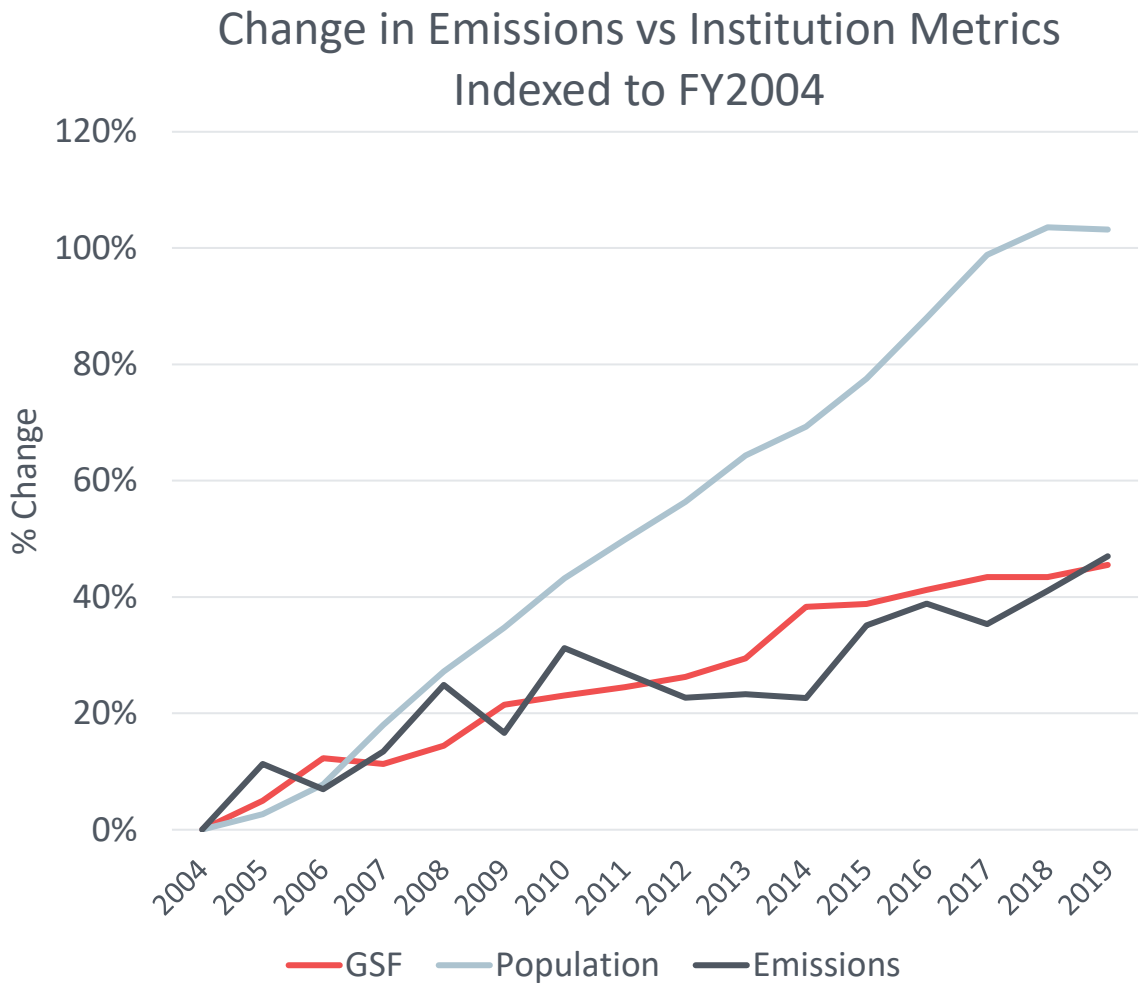
Longitudinal Tracking of Emissions by Scope

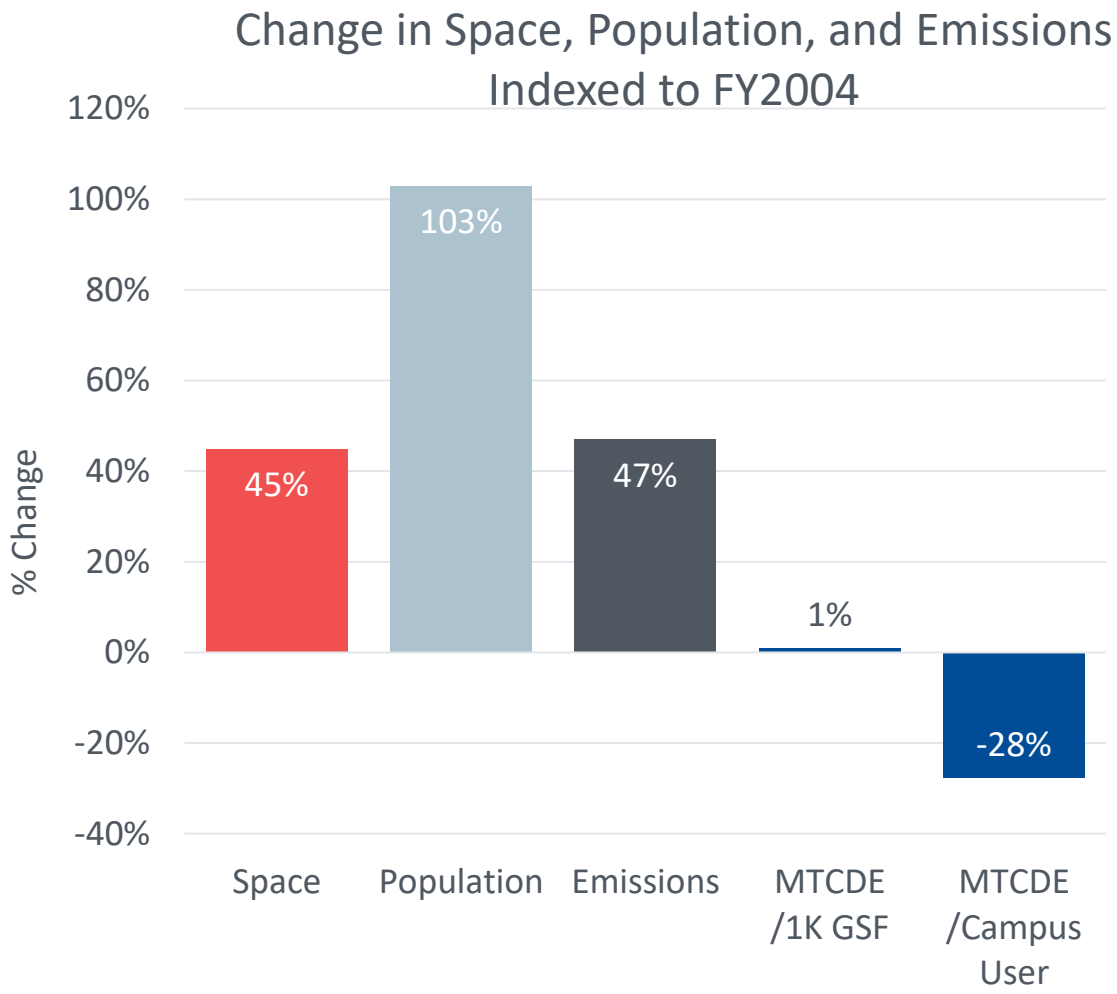
FY19 saw an increase in overall emissions compared to FY18, continuing to rise since 2017



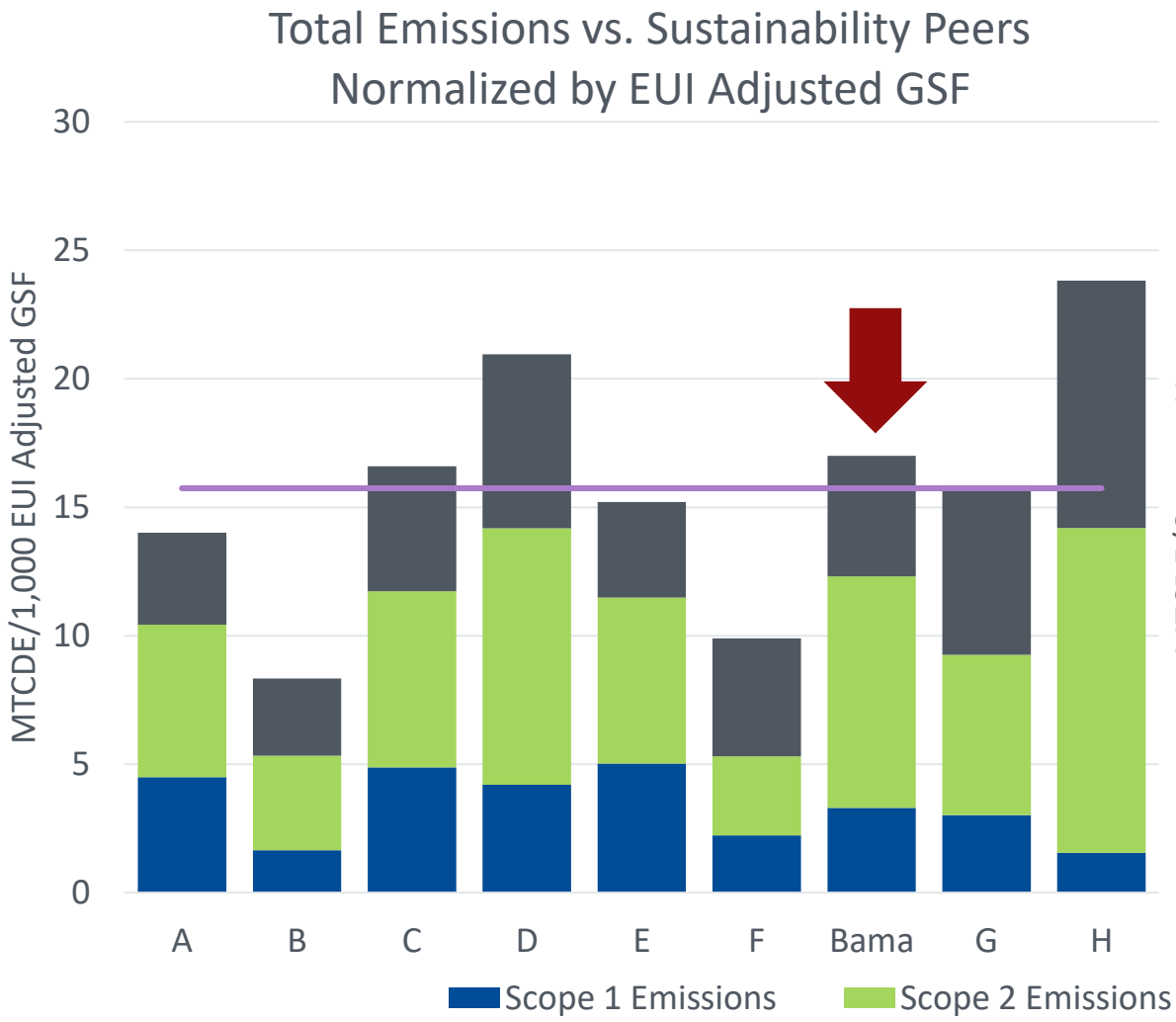
Stagnant/Deceasing (Normalized) Emissions

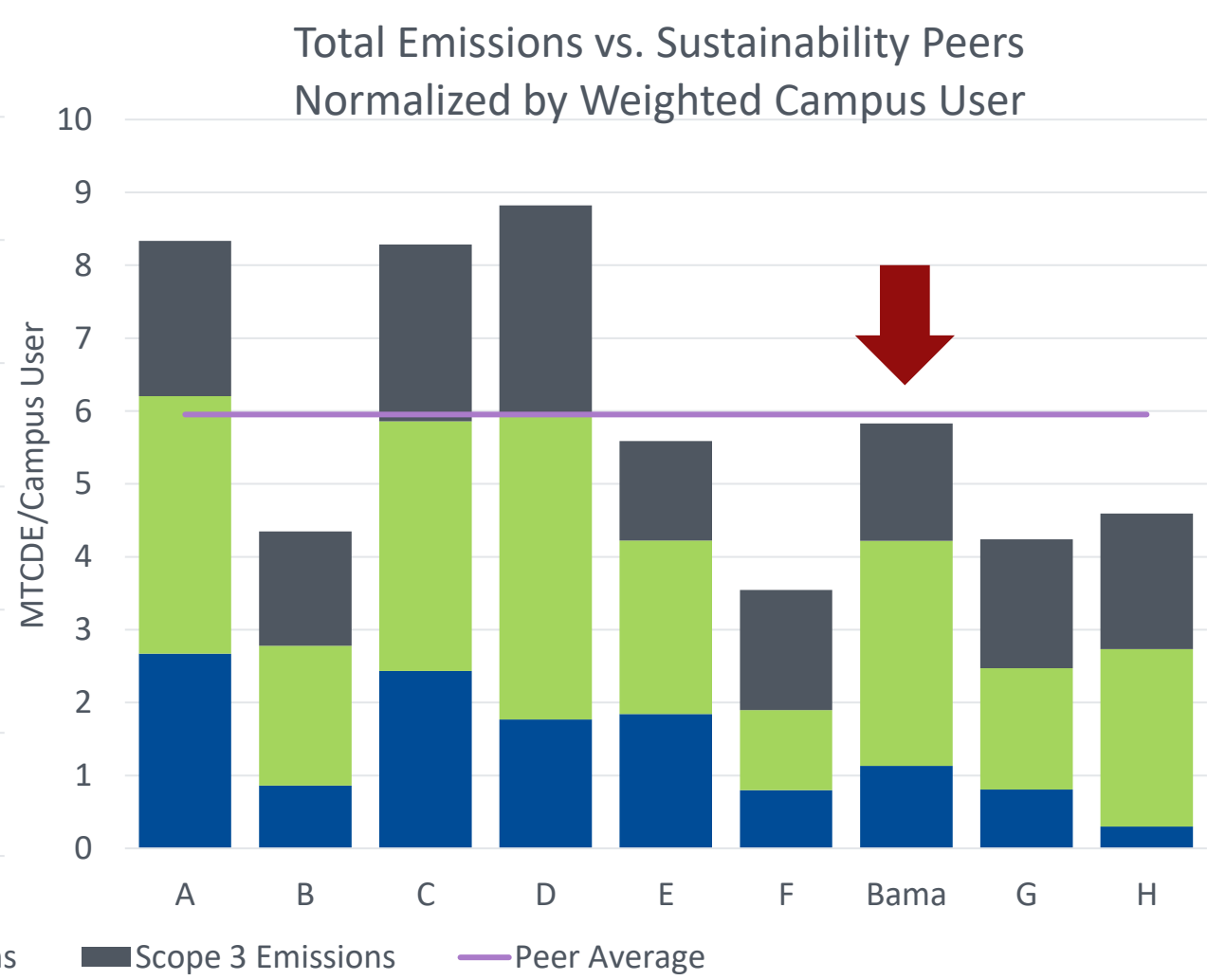
Data suggests campus facilities higher drive of emissions factors than student behavior





Tracking Alabama's Total Carbon Footprint





Tying Mission to Metrics

THE UNIVERSITY OF ALABAMA®

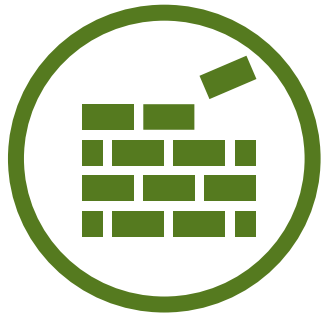
Mission

The Office of Sustainability will create a more sustainable tomorrow through research, teaching and promoting green initiatives and services within the University and surrounding communities. We will focus on the importance of recycling, reducing consumption, educating others on the importance of sustainability and providing sustainable solutions while being more aware of our environment in our local community as well as regionally, nationally and globally.

***Reducing consumption** = evaluating our steam management policies, seeing fossil consumption/gsf reduce*

***Focusing on the importance of recycling** = ratio of recycled to landfilled waste*

***Reducing consumption** = evaluating our energy policy, seeing electricity consumption/gsf reduce*

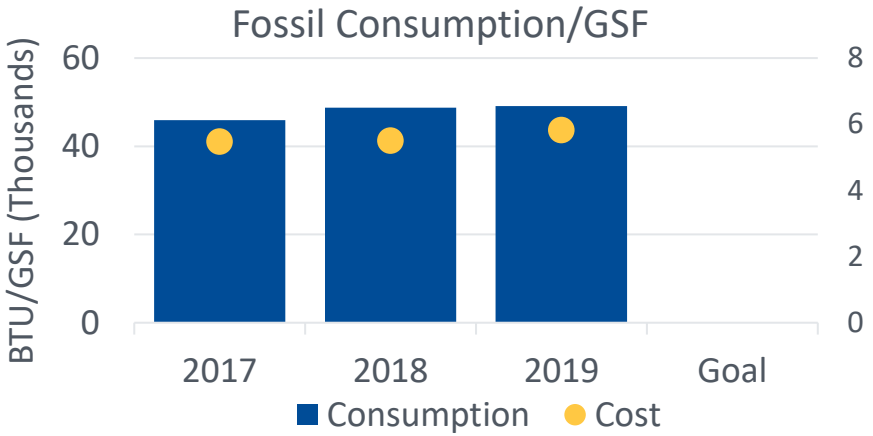


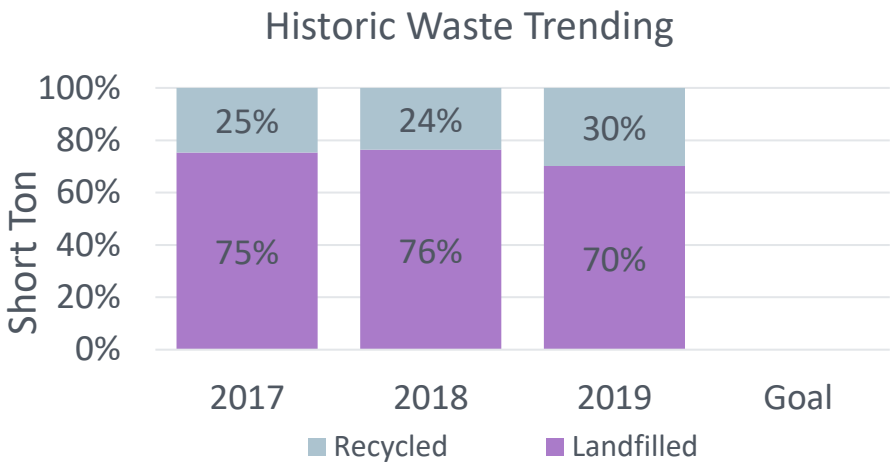
***Ensuring progress =** learn from building-level data in the past in order to inform future energy efficiency strategies.*

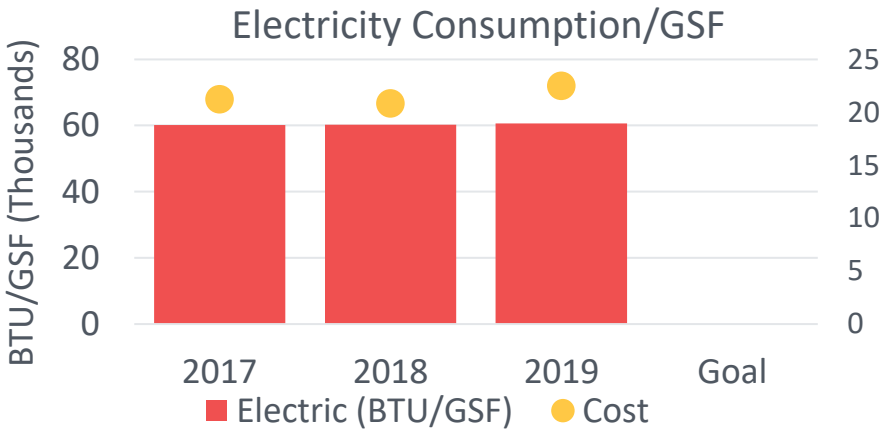
GORDIAN®

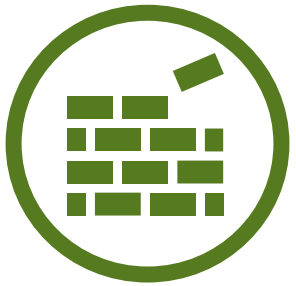
Mission taken from: http://sustainability.ua.edu/

Alabama FY19 Performance Against Metrics



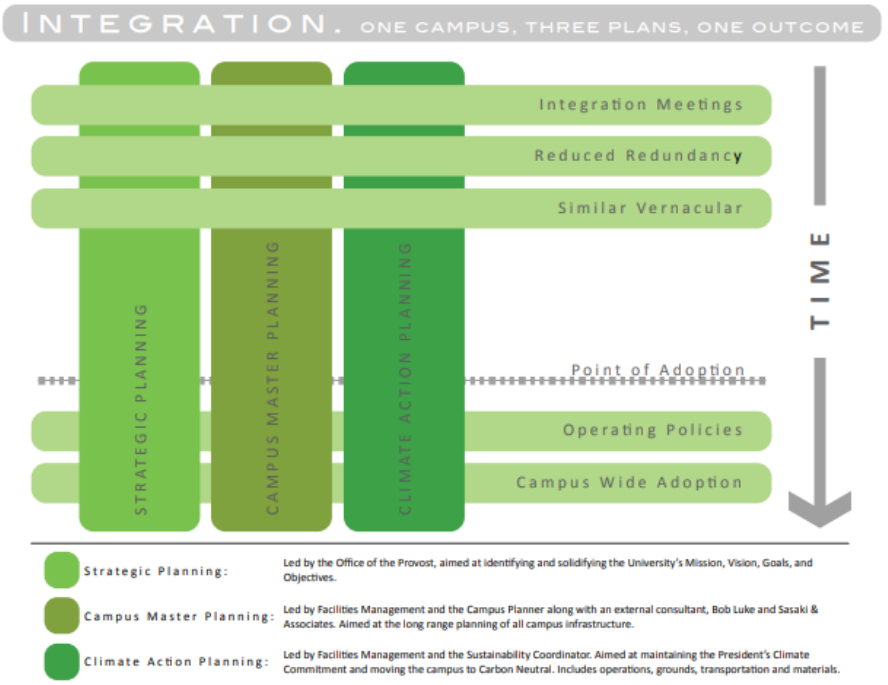






Using building-level energy and financial data, how can we create standards and strategies to ensure future investments provide the highest ROI in terms of energy efficiency possible?

Peer Climate Action Plans



Mississippi State University

University of Tennessee Sets Tangible 10 Year Goals

University of Tennessee's Sustainability Mission *"The Office of Sustainability works to coordinate, manage, advise, and report on sustainable initiatives at University of Tennessee, Knoxville through research, data collection, and collaboration with a variety of on-campus and community stakeholders."*

Goals

- FY 20-21, reduce/offset GHG emissions to 20 percent below FY 07-08 levels
- FY 30-31, reduce/offset GHG emissions to 40 percent below FY 07-08 levels
- FY 40-41, reduce/offset GHG emissions to 60 percent below FY 07-08 levels
- FY 50-51, reduce/offset GHG emissions to 80 percent below FY 07-08 levels
- FY 60-61, achieve carbon neutrality (zero net GHG emissions)*

*Taken from https://sustainability.utk.edu/wp-content/uploads/sites/69/2020/04/UTK-Sustainability-Master-Plan-2020-2030-Final.pdf

Texas A&M Employs KPI Structure to Ensure Progress

THE UNIVERSITY OF ALABAMA®

TEXAS A&M SUSTAINABILITY
RESPECT. PROTECT. PRESERVE.

Texas A&M Sustainability Mission *We work to respect, protect, and preserve the financial, environmental, and people resources that make Texas A&M and our community so great, not only for today, but also for future generations of Aggies. When Aggies commit to a sustainable lifestyle, we bring Texas A&M's core values to life.***

Approach

A KPI template-structure for each sustainability goal to use as a tool to track progress over their desired timeline. Their goals are for gradual reductions over the next 10 with scheduled benchmarks every 3 years

Achieve a 50% reduction in greenhouse gas emissions per weighted campus user by 2030; achieve net-zero emissions by 2050.

NO.	TARGET	ACTIONS	KEY PLAYERS
02-1	**Decrease campus energy use intensity.** **192** (2017) **182** (SHORT TERM) **174** (MEDIUM TERM) Campus Source Energy Use Intensity (kbtu/sf/year)	*Campus buildings can decrease energy use by:* • Increasing effectiveness of air-side heat recovery. • Updating building automation systems. • Communicating system feedback to end users. • Upgrading laboratory fume hoods. • Meaningfully integrating exterior shading solutions, such as that provided by trees or architectural features. *Aggies can cut energy use by:* • Turning off the lights when exiting a room. • Turning off and unplugging devices prior to extended campus breaks.	*Led by:* • Utilities and Energy Services *Supported by:* • All Aggies

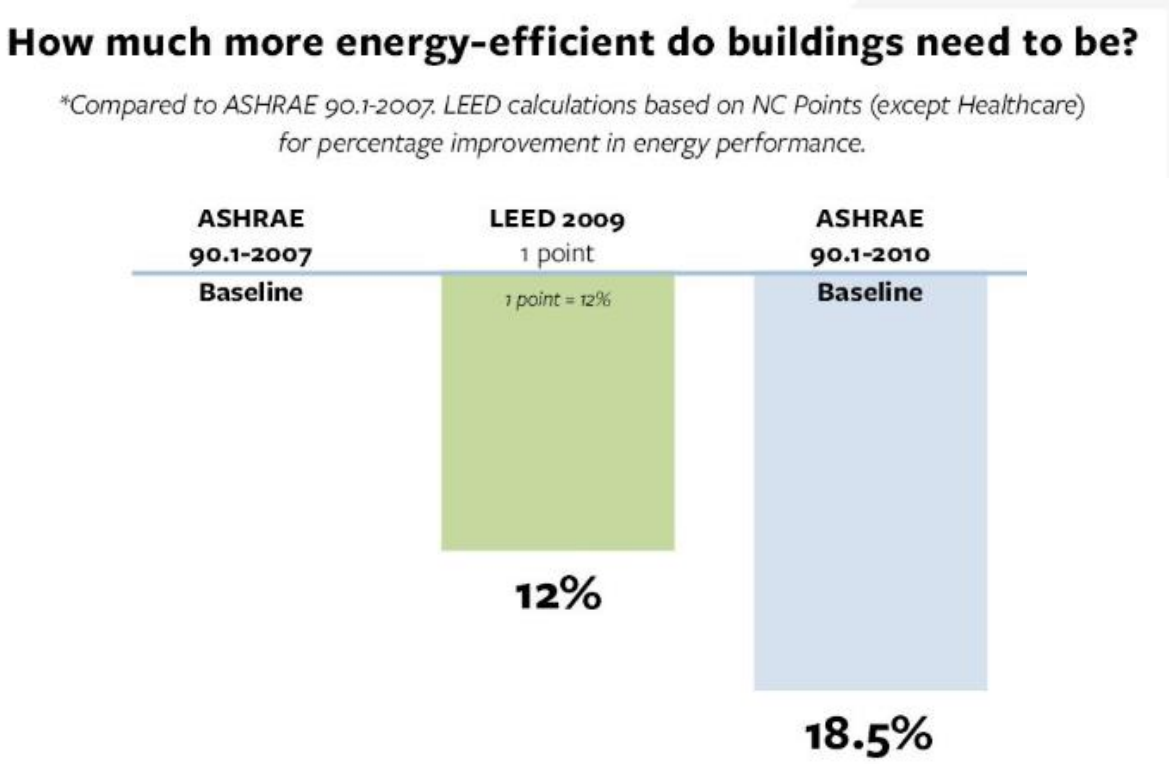
GORDIAN®

**Taken from http://sustainability.tamu.edu/home.aspx

Building Standards and Performance Tracking

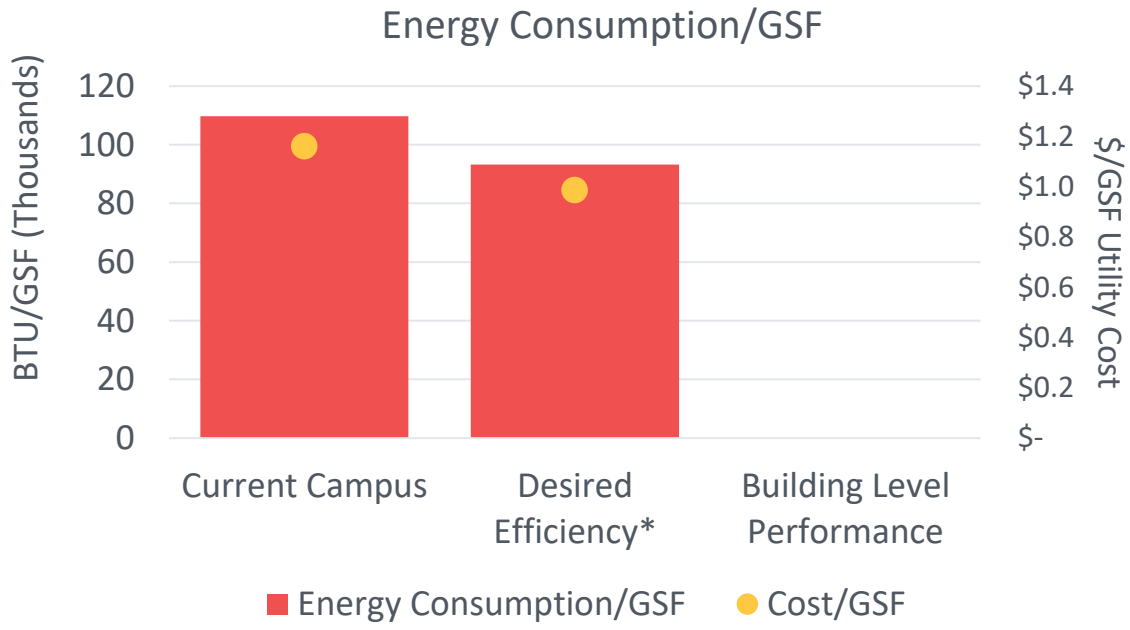
THE UNIVERSITY OF ALABAMA®

We have high hopes for our building design standards to improve efficiency



https://karpinskieng.com/insights/leed-v4-ashrae-90-1-2010-building-design

To ensure progress is heading in the right direction, we can use building level metering to justify these strategic decisions we have made. Tracking consumption in a newly renovated building like University Hall, built to these standards, versus an older-constructed building on campus can help us narrow down best energy efficiency practices and continue advocating for those decisions in the future.



GORDIAN®

*discounted 15% in accordance with ASHRAE estimates. This is an estimate that can be tailored to your university

GORDIAN®

Building knowledge

Questions & Discussion

Appendix I: Glossary of Terms

Glossary of Terms

- **Scope 1 (direct)** – Emissions from the power sources owned or controlled by the institution, including on-campus stationary fossil fuel sources; mobile sources, such as the vehicle fleet; and fugitive sources, such as refrigerants and fertilizer
- **Scope 2 (indirect)** – Indirect emissions from sources that are neither owned nor operated by your institution but whose products are directly linked to on campus energy consumption. This includes purchased energy: electricity, steam, and chilled water.
- **Scope 3 (indirect)** – Any other indirect emissions, including commuting by faculty, staff and students, air travel by faculty, paper, solid waste, wastewater, research animals and scope two transmission and distribution losses
- **Global Warming Potential (GWP)**- a relative measure of how much heat a greenhouse gas traps in the atmosphere. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide.
- **MTCDEs (Metric Tons of Carbon Dioxide Equivalent)**- The carbon footprint is reported in metric tons of carbon dioxide equivalents (CO2e)5. This measure includes all six greenhouse gases, which are converted to CO2e based on their 100-year global warming potential
- **Density Factor-** A measure of the amount use the campus buildings receive on a daily basis/The number of campus users per 100,000 GSF
- **Technical Complexity-** the relative mechanical complexity of the campus on a scale of 1-5

GORDIAN®
Building knowledge

THE UNIVERSITY OF ALABAMA®

Appendix II: Selected Case Studies

University of Michigan – Tracking Success From Initiatives

- "Over the last ten years, ECMs implemented by Kevin Morgan's team have saved $1.5 million per year, totaling over $12.5 million to date. These savings are the direct result of reducing energy consumption by 30,451 MMBTU per year on average, mitigating 4,163 metric tons of CO2 equivalent (MTCO2e) annually. One particularly effective ECM has been the **installation of occupancy sensors**. **The Chemistry buildings' sensors cost $75,660 to install and have since generated average annual savings of $290,497, totaling over $1.1 million to date.** The sensors easily reduce energy consumption by turning off lights and air circulation when a sensor's region is unoccupied. They are most effective in lab spaces due to the energy intensive process of constantly cycling air into and out of the room.
- A common energy efficiency upgrade throughout campus has been the replacement of fluorescent light bulbs with LED bulbs. The latter consume 20% less electricity for the same light output as the former and last over twice as long, reducing both electricity and maintenance costs […] one floor of bulb replacements [in a 160,000 gsf academic building] cost $1,637 and generates $1,842 in average annual savings."

https://energy.umich.edu/wp-content/uploads/2019/04/REF-Final-Report-1.pdf

Michigan State University

THE UNIVERSITY OF ALABAMA®

- “As part of its commitment to going greener, Michigan State University’s Board of Trustees today authorized the installation of a 20-megawatt solar array.
- The array will be located on nearly 100 acres just south of MSU’s main campus between Bennett and Jolly roads. It will produce the energy equivalent of powering 4,400 homes and triple the campus’s use of renewable energy. Once complete, MSU’s solar arrays – which include previously installed solar carports – will span nearly 145 acres.
- ‘The sustainability of our environment goes hand in hand with the well-being of our students, faculty and staff at Michigan State,’ said MSU President Samuel L. Stanley Jr., M.D. ‘This project not only furthers MSU’s commitment to renewable energy, it also provides a cleaner future for our campus, the world and the next generation of Spartans.’
- The project is expected to cost about $2.3 million and will be funded with MSU utility reserve funds. It is estimated that the array will begin producing power by the end of 2022 and save the university at least $27 million in the next 25 years, with potential savings much higher.”
- https://msutoday.msu.edu/news/2020/msu-trustees-approve-installing-a-100-acre-solar-farm/

GORDIAN®

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/

Arizona State University

THE UNIVERSITY OF ALABAMA®

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

GORDIAN®

https://cfo.asu.edu/solar

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

GORDIAN®