

SAS Carbon Inventory

Fiscal Year '19 (July 2018 - June 2019)



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Intro & Mission

As Penn's oldest school and home of the Earth and Environmental Sciences, as well as numerous energy research centers, Arts & Sciences Sustainability has a strong drive to lead by example in many areas of sustainability, foremost energy and carbon reduction. In early 2017, SAS Sustainability undertook the task of creating the School's first Carbon Inventory. A University-wide carbon inventory was undertaken with the writing of Penn's initial Climate Action Plan in 2009, but no individual school had undertaken a carbon inventory up until that point. Much like the University-wide carbon inventory, SAS' intent was to determine the sources of the School's carbon emissions and inform decisions on ways to reduce those emissions that would ultimately contribute to the University's goal of carbon reduction to the point of neutrality. The School has decided to update the inventory every three years moving forward, with FY 2019 as the first year of update and comparison to FY 16.

Advances in metering technology and deployment in all university buildings enabled SAS to have reliable data for baseline building emissions. The successful implementation of several Century Bond energy reduction projects in SAS buildings created a need to look beyond the "low hanging fruit" of energy reduction and determine more difficult to address sources of energy consumption and carbon emissions. What resulted was a year-long exercise into methodology, data compilation and interpretation, and ultimately this report.



Scopes & Types of Energy Included

The carbon inventory of the School of Arts and Sciences includes emissions from scope 1 (direct), scope 2 (indirect), and scope 3 (indirect) sources. The scope categorization was determined based off Penn's main campus carbon inventory to maintain consistency with wider University reporting. The scopes in both the SAS and University carbon inventory follow the EPA's guidelines for defining scope¹. Scopes were included in the SAS Carbon Inventory when they had a significant carbon impact at the School level and when reliable data was available from which to calculate accurate metrics.

The SAS Carbon Inventory examines institutional greenhouse gas (GHG) emissions from three specific categories within the emission scopes: van fleet, building, and air travel.

Scope 1 (direct emissions)

Van fleet emissions: This includes sources of emissions that are released through gasoline consumption for SAS-owned vehicles that are part of the School's van fleet. In FY '19 the SAS van fleet had a total of 4 vehicles, two fewer than FY '16. These vehicles are used both on and off campus for facility-related work and academic or research-related trips.

Scope 2 (indirect emissions)

Building emissions: This includes all sources of emissions that are released through electric, steam and chilled water usage for University-owned, SAS campus buildings. The School's

building portfolio can be divided into three main types: laboratory, classroom/ office and historical buildings. (See Appendix A)

Scope 3 (indirect emissions)

Air travel emissions: This includes sources of emissions that are released through fuel usage for institutionally sponsored air travel at the School. The air travel emissions in this inventory include precise data from Penn's online travel booking system, World Travel Booking, as well as reimbursements submitted through Concur, to fully capture the School's emissions from this scope

Emission conversion factors from Penn's Center for Environmental Building & Design were used when calculating these emissions to stay consistent with the University's carbon reporting methodology. Each form of energy consumed by the School was converted and recorded in the standard emissions unit of Metric Tons of Carbon Dioxide Equivalent (MTCDE) to provide a metric for comparable analysis at the School and University level. Since 2016 the school updated its methodology for calculating airline mileage to give more specific estimations.

Emission conversion factors from Penn's Center for Environmental Building & Design were used when calculating these emissions to stay consistent with the University's carbon reporting methodology.

¹ United States Environmental Protection Agency. "Greenhouse Gases at EPA," Sept. 6, 2017, <https://www.epa.gov/greening-e-pa/greenhouse-gases-epa>

Method

Baseline year and how it was determined

The SAS Carbon Inventory was developed to analyze the School's carbon footprint and to determine a baseline from which to monitor progress. The baseline year was selected as Fiscal Year 2019 (July 2018 – June 2019) as a follow up to the previous Fiscal Year 2016 report. We chose 2019 to analyze the carbon footprint before any interference from the COVID-19 pandemic.



SUMMARY: FY19 BUILDING, VAN FLEET, AIR TRAVEL EMISSIONS

Summary of Emissions (MTCDE):

Scope 1 Emissions	39.37 (0.1%)
Scope 2 Emissions	22,003.56 (58.8%)
Scope 3 Emissions	15376.88 (41.1%)

Scope 1 Emissions (MTCDE)

Van Fleet	39.37 (0.001%)
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Scope 1 Emissions (MTCDE)

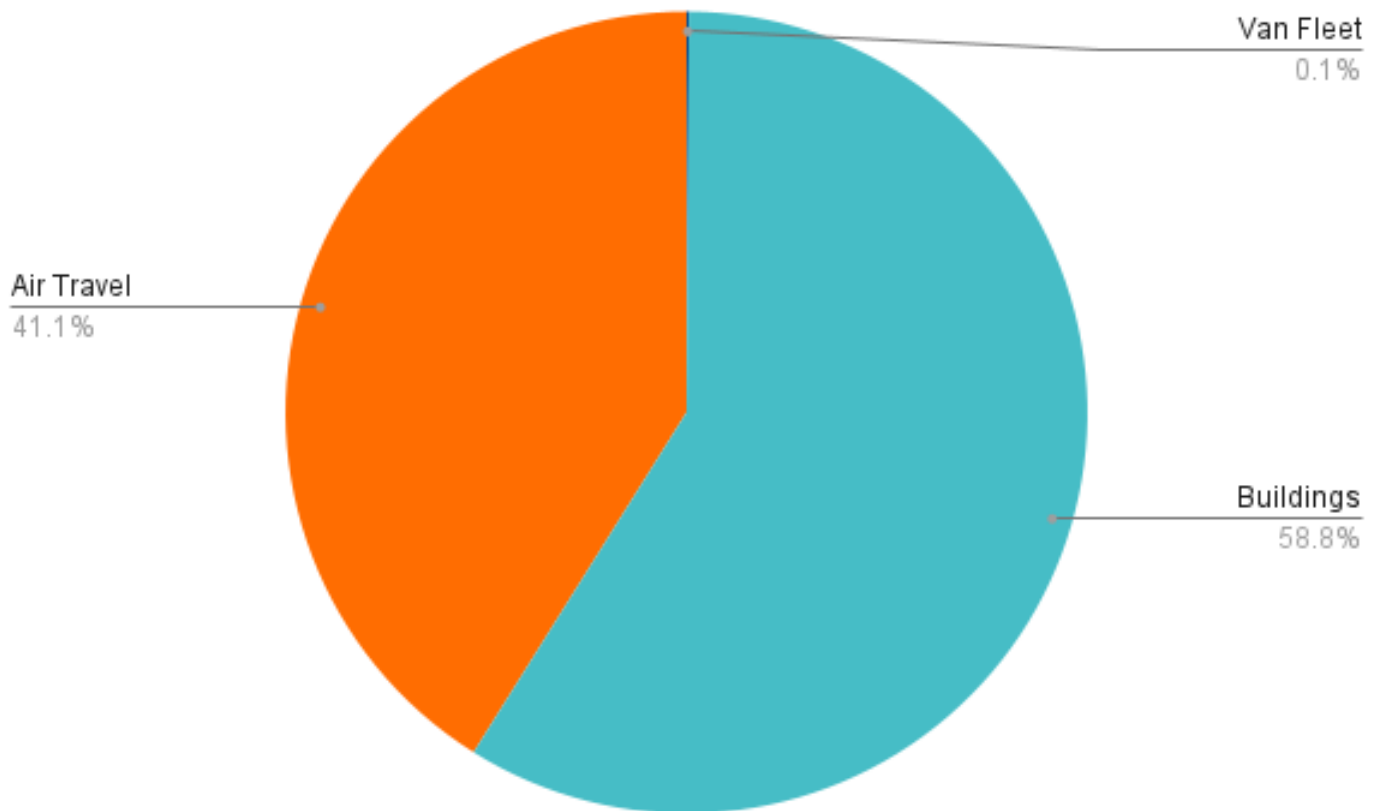
Buildings	22,003.56 (58.8%)
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Scope 3 Emissions (MTCDE)

Air Travel	15376.88 (40%)
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FY19 at a glance

- Building energy metered data was available for 18 SAS buildings
- Over 1,100 academic-related trips were taken nationally & internationally
- The SAS Van Fleet had 4 vehicles



SUMMARY: FY19 AND FY16 COMPARISON

Summary of Emissions (MTCDE):

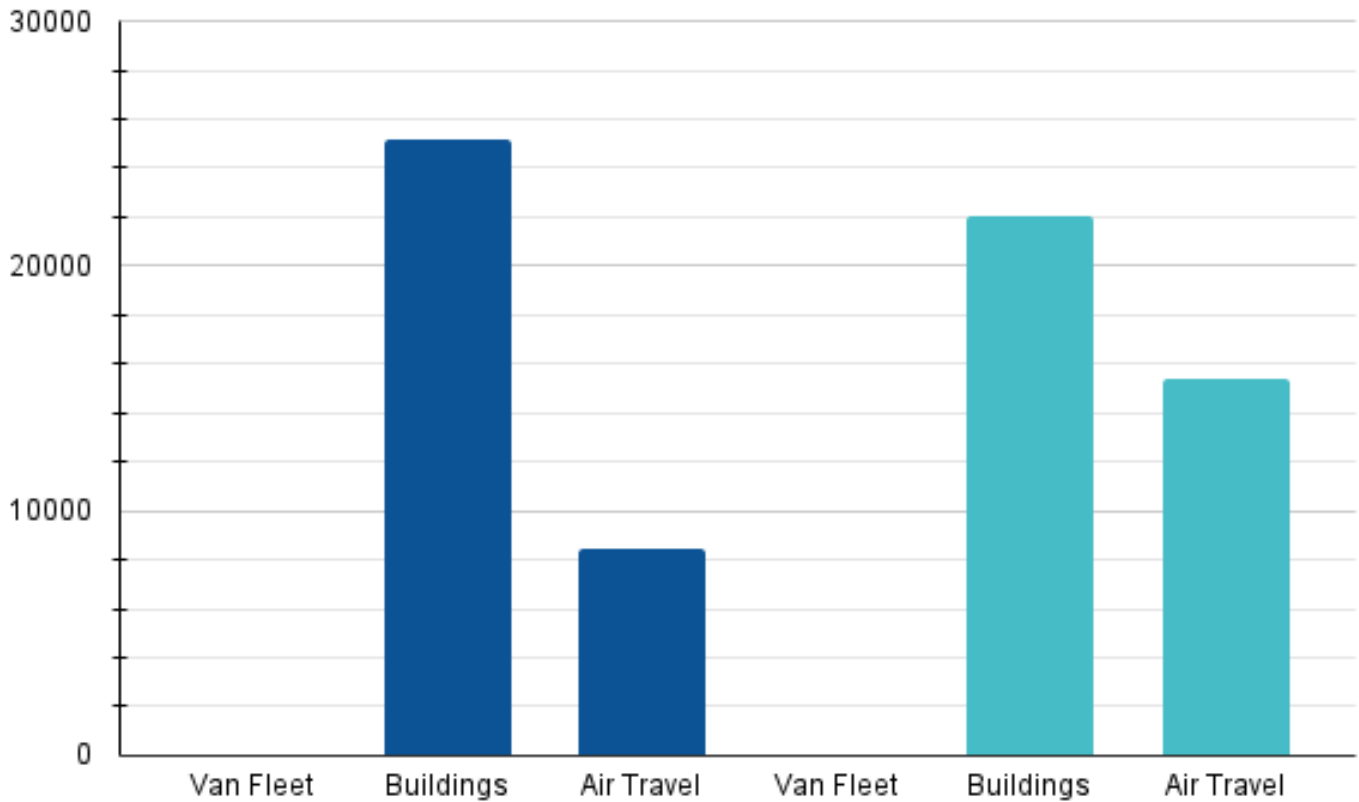
Van Fleet	FY16 (41.2) FY19 (39.37) (-1.83)
Buildings	FY16 (25188.96) FY19 (22003.56) (-3185.40)
Air Travel	FY16 (8467.01) FY19 (15376.88) (+6909.87)

Differences Between Fiscal Years

- Stiteler Hall is no longer a School of Arts and Sciences Building.
- Perelman Center for Political Science and Economics was built.
- Since 2016, the university has updated its airline tracking methodology to get more precise data.

EMISSIONS BY SOURCE
FY16

EMISSIONS BY SOURCE
FY19



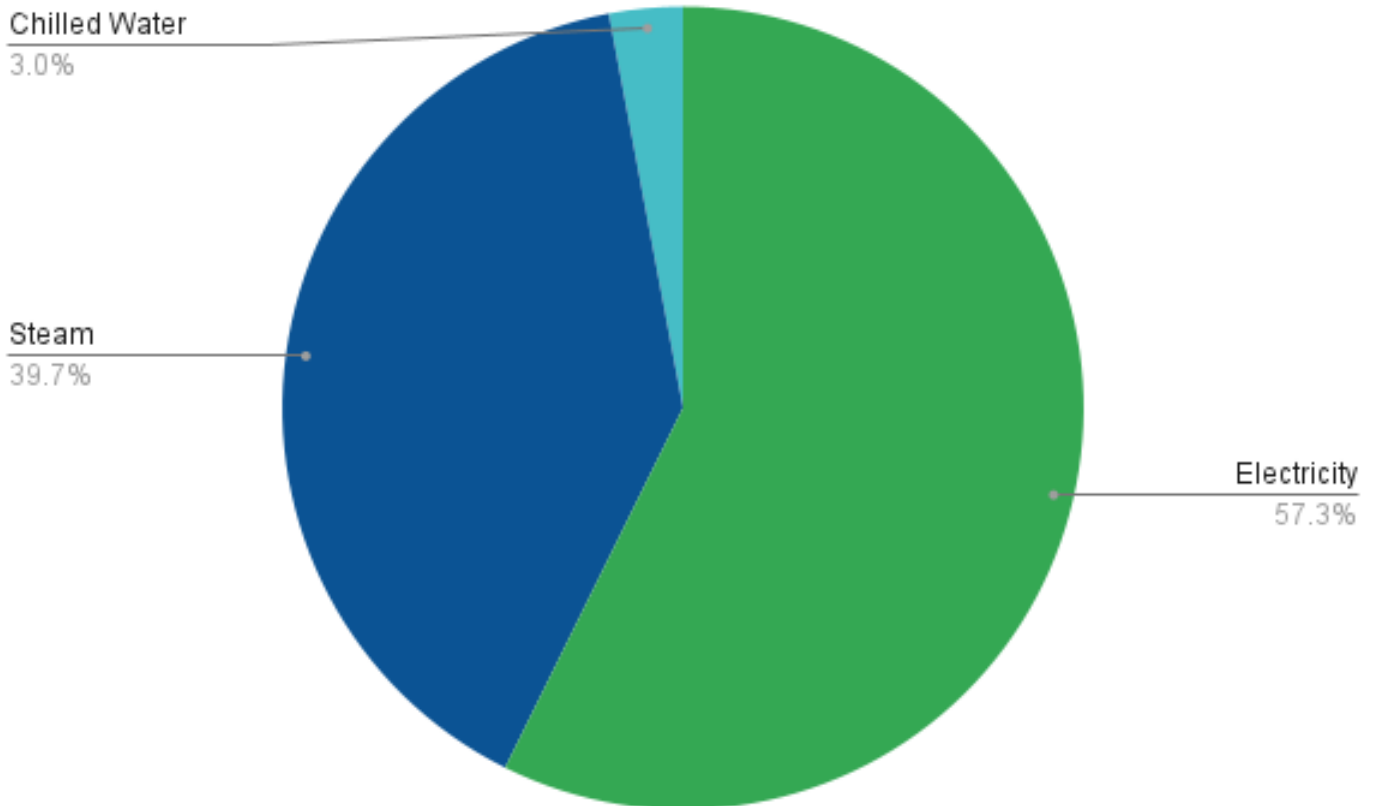
SUMMARY: FY19 BUILDING EMISSIONS BY ENERGY TYPE

Summary of Emissions (MTCDE):

Electric	12,487.4 (57.3%)
Steam	8651.18 (39.7%)
Chilled Water	647.08 (3%)

FY 16 at a glance

- The Ronald O Perelman Center for Political Science and Economics was completed as a LEED Gold building.
- (Building infrastructure project) Leidy Century Bond completed
The School began design of the Vagelos Laboratory for Energy Science and Technology, to house the Vagelos Institute and facilitate cross-disciplinary energy research.



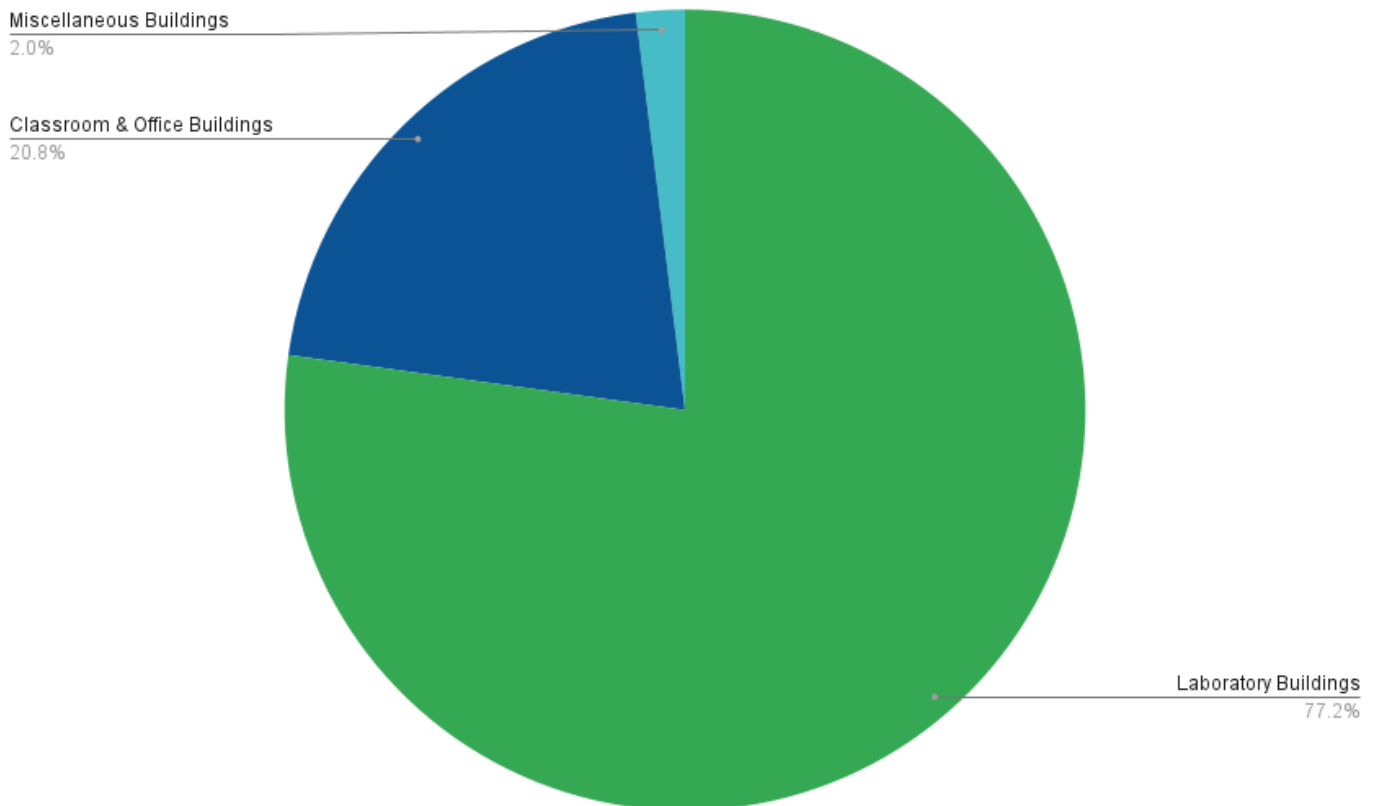
SUMMARY: FY19 BUILDING EMISSIONS BY BUILDING TYPE

Summary of Emissions (MTCDE):

Laboratory	16,817.02 (77.2%)
Classroom & Office	4539 (20.8%)
Miscellaneous	429.07(2%)

Definition of Building Type

- Laboratory: buildings whose primary use is research-related laboratory work. These buildings are composed primarily of wet laboratories but also include energy-intensive dry laboratories, such as a laser labs
- Classroom & offices: buildings whose primary use is for classroom and office space. This includes Central Pool classrooms, seminar rooms and faculty, staff & and student offices
- Miscellaneous: small historic residential buildings that have been converted to office or classroom space.



Appendix A

Buildings included in the SAS carbon inventory:

Laboratory Buildings:

Chemistry Laboratories - Cret Wing
Chemistry Laboratories - 1958 Wing
Chemistry Laboratories - 1973 Wing
Vagelos Laboratories
Carolyn Hoff Lynch Biology Lab
Leidy Laboratories of Biology
David Rittenhouse Laboratory

Classroom & Office Buildings:

Fisher Bennett Hall
Goddard Laboratories
Perelman Center for Political Science and Economics
McNeil Center for Early American Studies
Claudia Cohen Hall
McNeil Building
Lerner Center
Solomon Laboratories
David Rittenhouse Laboratory
Williams Hall

Miscellaneous Buildings:

Fels Center of Government
Jaffe History of Art Building