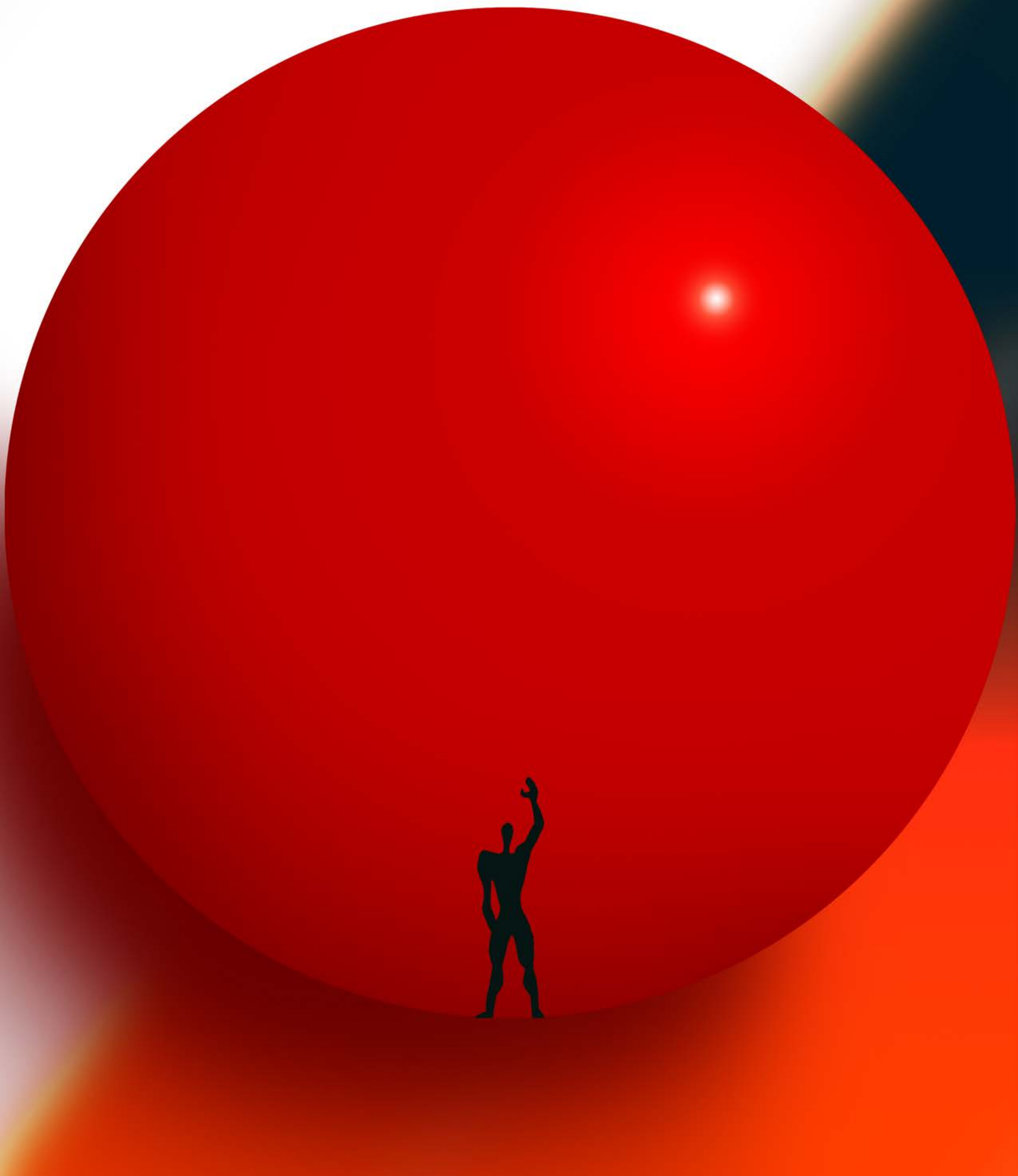
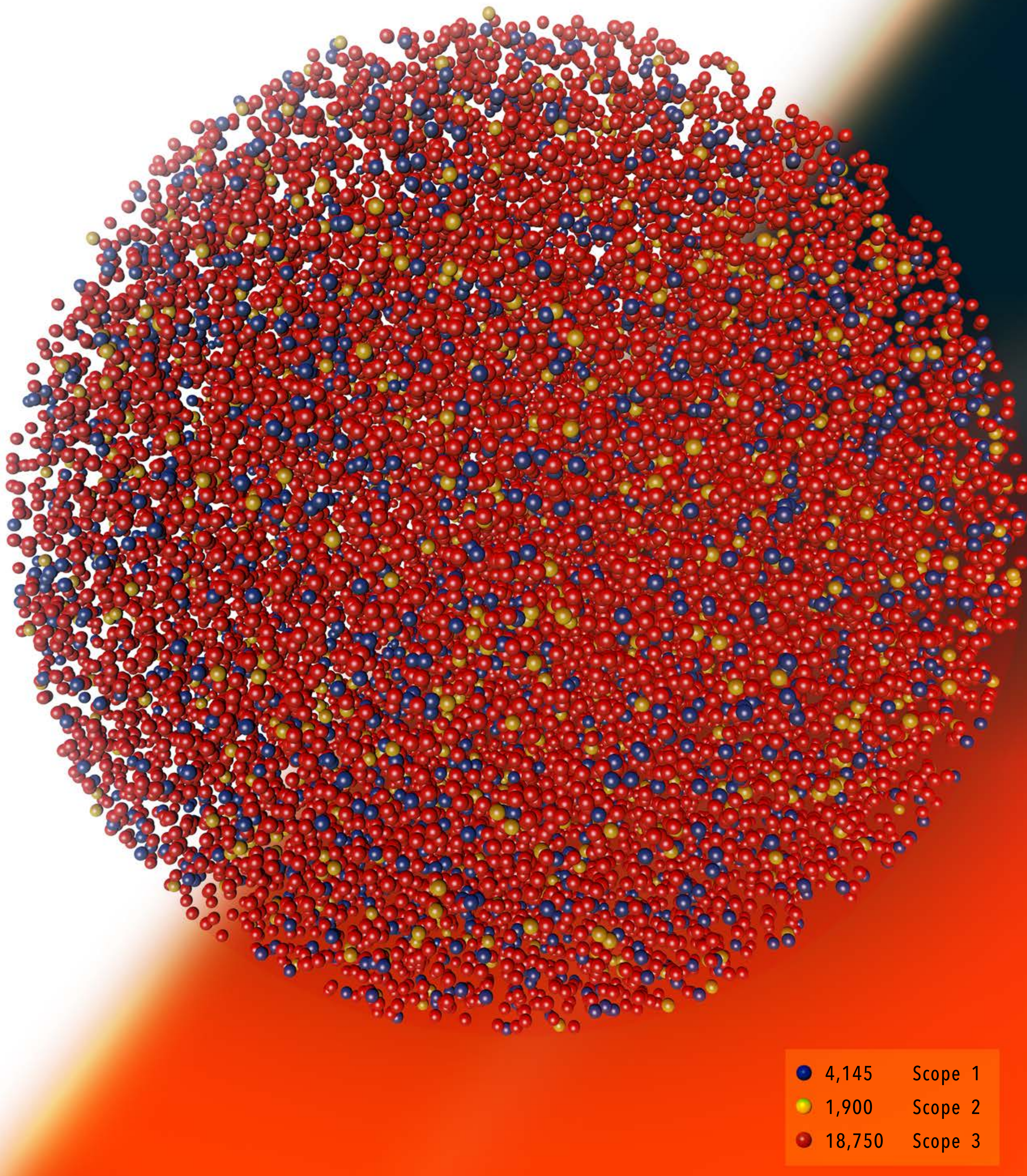
SA+P

2020 CLIMATE ACTION PLAN

1 METRIC TON OF CARBON DIOXIDE EMISSIONS
(1 MTCO2e)



TOTAL SA+P GHG EMISSIONS, FY2019
24,795 MTCO2e



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EXECUTIVE SUMMARY

The climate crisis is not years or decades ahead, *it is here*. Virtually all governments and scientists agree that humans are causing global warming and that global warming will intensify in coming years. We must address this issue now: climate change and volatility are already increasing inequity, injustice, threats to health, and risks to the environments that humans live in. Acting on climate change is necessary to preserve and further our work in the School of Architecture and Planning, and should be a focus of our research and teaching. Not acting on climate change will threaten everything that we study and stand for. If left unaddressed, the climate crisis will further exacerbate the other multiple crises that we face in 2020.

We believe that the MIT School of Architecture and Planning (SA+P) has a unique opportunity to move towards sustainability at this time and could even play a leading role in modeling climate action for the Institute as a whole. This document summarizes analyses, goals, programs, and plans for actions that SA+P could incentivize, for the school's departments, labs, and centers (DLCs) to reduce their carbon emissions. If we seize the opportunities outlined in this document, there is the potential to:

a) lead the Institute in a new area, reducing Scope 3 emissions, that would put MIT on par with other university climate leaders;
b) amplify the broader climate goals of the Institute; and
c) change how the administration, faculty, and students think about taking climate action.

Based on meetings in the fall and spring of 2020, the SA+P Dean and School Council asked us to develop a schoolwide plan for sustainability, to ensure that the entire SA+P community could contribute to, and coordinate with, the Institute's larger plans for climate action. This climate action plan articulates the rationale for taking action, develops an analysis for each DLC within SA+P (based on pre-coronavirus data), and presents a menu of options for actions. These actions include goals, commitments, and pilot projects that all aim to reduce our greenhouse gas (GHG) emissions going forward and can seed broader campus-wide strategies. Gathering data from these pilots will also guide better use of our current facilities and can also inform renovation of the MET Warehouse scheduled to begin fall 2020. We hope that each DLC will set goals, make commitments, and plan to adopt pilot projects during the month of September. If we are able to develop a schoolwide strategy, and coordinate with an Institute-wide sustainability goal that is expected to be released in October, this will establish us as leaders on climate action within the Institute and among universities.

This climate action plan was developed in conjunction with a comprehensive plan for climate resilience, but we submit them as two separate documents since they address fundamentally different problems and solutions.

Submitted to the members of SA+P School Council, September 22, 2020, by Professors David Hsu and Caroline A. Jones, with the collaboration and research efforts of SA+P graduate students Ruoming Fang, Kailin Jones, Mariana Medrano, and Diego Hernan Castillo Peredo. We worked closely in partnership with members of the MIT Office of Sustainability: Julie Newman, Jeremy Gregory, Brian Goldberg, Stuart Iler, and Steven Lanou.

Thank you to the many MIT staff and faculty who contributed their insights, thoughts, and feedback for this plan, in alphabetical order: John Attanucci, Nicole Bernabei, Siobhan A Carr, Nicole Degnan, Randa Ghattas, Jim Harrington, Mariana Liebman-Pelaez, Nicholas de Monchaux, Les Norford, Morgan Pinney, and Christoph Reinhart.

Errors of course belong to the authors alone.

SECTION 1. INTRODUCTION AND RATIONALE

The MIT School of Architecture and Planning (SA+P) has achieved top rankings in its departments, with labs and centers contributing to the school's leading position. Its departments, labs, and centers feature many of the best researchers, teachers, practitioners, and students working in the built environment today. Around the world, SA+P is a leading voice for understanding how to shape communities and the built environment towards a more equitable, beautiful, stimulating, and productive future. We now have the opportunity to take a leadership role within the larger Institute as it addresses one of the greatest crises of our time, climate change.

The United Nations Intergovernmental Panel on Climate Change (2018) stated that climate change has already resulted in rising temperatures and more extreme weather events, with more intense changes to come, resulting in sea level rise, loss of habitats, extinction of species and ecosystems, and risks to health, food, water, and economies.[1] If global GHG emissions continue to grow unabated, then all of these effects will be even more severe, affecting most harshly the poorest people in countries that traditionally consume the least energy.

Humanity has been slow to act on climate change and is now courting disaster. Both the fact of a warming atmosphere and its human causes have been understood for more than a century, and scientists, policymakers, and corporations have understood for more than forty years that the likely consequences of society's continued use of fossil fuels would be catastrophic.[2] Only recently has the general public begun to understand that climate change is now a current crisis that will rapidly worsen if humanity does not take immediate action to transition to sustainable and renewable sources of energy, while also reducing overall energy use. The climate is now changing more rapidly than scientists have predicted and addressing this problem is now among the top concerns in many countries around the world.[3] The young people that MIT exists to educate have grown since childhood with an awareness of climate change and increasingly expect society to take action.[4]

As a self-consciously elite institution -- and in order to remain in a leadership position -- MIT must demonstrate that it is able and willing to model the actions that all of society needs to undertake. As a result, MIT plans to make much more aggressive commitments to climate action in the fall of 2020. The Institute has recently announced its intention in the summer of 2020 to create a series of Climate Grand Challenges[5] for research. In addition, the City of Cambridge[6], the City of Boston[7], and the Commonwealth of Massachusetts[8] have already made aggressive commitments to lower their carbon emissions.

Action towards climate change may seem comparatively distant amidst the seemingly more immediate problems of public health, economic suffering, and racial injustice, but there are three reasons why it is necessary for the Institute and SA+P to take action now. First, climate change will exacerbate all of the other problems listed above. Second, it is unlikely that things will "return to normal" any time soon, and any idea of what is "normal" must be questioned

1 {United Nations Intergovernmental Panel on Climate Change}, 'Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming of 1.5°C: Summary for Policymakers', 2018. Link: http://www.ipcc.ch/report/sr15/. Accessed 2 November 2018

2 Naomi Oreskes and Erik M. Conway, Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming (Bloomsbury Publishing USA, 2011); Spencer Weart, 'The Discovery of Global Warming [Excerpt]', Scientific American, 2012

3 Moira Fagan and Christine Huang, 'A Look at How People around the World View Climate Change', Pew Research Center, 2019 <https://www.pewresearch.org/fact-tank/2019/04/18/a-look-at-how-people-around-the-world-view-climate-change/> [accessed 13 November 2019]; Cary Funk and Brian Kennedy, 'How Americans See Climate Change in 5 Charts', Pew Research Center, 2019

4 Matthew Bellew and others, 'Do Younger Generations Care More about Global Warming?', Yale Program on Climate Change Communication, 2019. <https://climatecommunication.yale.edu/publications/do-younger-generations-care-more-about-global-warming/> [accessed 31 July 2020].

and adjusted after these multiple crises. Third, and perhaps most relevant for SA+P, in a time of great change, it is necessary not only to recover but also to build well for the future.

SA+P must therefore lead and act on climate change. As a community of students, teachers, designers, architects, planners, media scientists and engineers, theorists and historians, artists, real estate experts, urbanists, and practitioners, our professional and intellectual mission is to build a better world -- crucially by understanding correctly the history and structures implicit in the world we have already built. We must recognize that the better world we want will necessarily confront profound climate change. Can we change that future, by improving equity, justice, and the quality of life for all diverse life forms on the planet? This charge is central to the mission and work of SA+P.

We are a particularly influential voice on the MIT campus regarding issues of how faculty, students, and staff live, work, and engage with the surrounding cities of Cambridge and Boston, as well as how we plan, build, and manage our campus. We are in the process of designing and renovating a distinctive part of that campus, the MET Warehouse. Now is the time to work together to elevate climate action to the top of our agenda, propelling it to the highest levels of the Institute by demonstrating to the administration and to the other five colleges and schools at the Institute that it is possible, and indeed urgent, for faculty, students, and staff to make common-sense changes to reduce our carbon emissions.

This report begins with an analysis of the nature and sources of GHG emissions from our activities in 2019. We then detail opportunities for SA+P to set goals, make commitments, and pilot climate actions to reduce our direct and indirect carbon emissions. We then lay out the process for adopting these goals, commitments, and pilots in order maximize the effect of these efforts, both to support and lead the Institute's efforts towards carbon neutrality.

5 See: http://climategrandchallenges.mit.edu/

6 See: https://www.cambridgema.gov/~/media/Files/CDD/Climate/climateplans/climate_plan.pdf

7 See: https://www.boston.gov/sites/default/files/embed/file/2019-10/city_of_boston_2019_climate_action_plan_update_4.pdf

8 See: https://www.mass.gov/info-details/ghg-emissions-and-mitigation-policies

SECTION 2. ANALYSIS OF GREENHOUSE GAS EMISSIONS (GHG) IN SA+P BY UNIT

Focus of Analysis

Defining Scope 1, 2, and 3 emissions

In order for SA+P to coordinate with and support MIT's climate efforts, we must first convey how the Institute measures its greenhouse gas (GHG) emissions, and understand previous efforts to reduce these. It is also important to clarify the concepts of direct and indirect emissions, to make clear how MIT, SA+P within it, and other institutions (cities, companies, and universities in general), are responsible for GHG emissions through their regular operations and activities.

The Greenhouse Gas Protocol's Corporate and Accounting Standard (https://ghgprotocol.org/corporate-standard) defines three categories of GHG emissions according to how they fit into an organization's operations. Direct GHG emissions are emissions from sources that are owned or controlled by the organization (Scope 1). Indirect GHG emissions are emissions that are a consequence of the activities of the organization but occur at sources owned or controlled by another company (Scope 2). Scope 3 takes this logic outward, to worker activities such as commuting. The Protocol defines these three scopes to facilitate reporting of direct and indirect emissions, as summarized here:

Category	General Name	GHG Protocol Definition	MIT Examples
Scope 1	Direct emissions	GHG emissions from sources that are owned or controlled by the company.	GHG emissions from the central power plant, individual building heating systems, and operation of fleet vehicles.
Scope 2	Electricity indirect GHG emissions	GHG emissions from the generation of purchased electricity consumed by the organization.	GHG emissions from electricity purchased from utilities.
Scope 3	Other indirect or value chain GHG emissions	GHG emissions that are a consequence of the activities of the organization, but occur from sources not owned or controlled by the organization.	GHG emissions from purchased goods and services, business travel, waste, employee commuting, leased space, and other activities.

Table 2.1

Scope 3 as an opportunity for leadership

MIT has committed to a goal of a 32% reduction of Scope 1 and 2 GHG emissions below 2014 levels by 2030, but Scope 3 is a special opportunity for SA+P because MIT has not yet made any commitments in this area. Moreover, this category of consumption- and waste-based emissions is especially related to SA+P's focus on cities and urbanism.

We believe that SA+P adopting Scope 3 goals can set the standard for how cities should begin this level of action. Dense cities often congratulate themselves for their relative sustainability based on their energy use on a per capita or per area basis, compared to areas that are less densely settled or with fewer industrial or manufacturing activities. However, dense urban areas directly cause GHG emissions by consumption and waste, and this category of GHG emissions is significantly larger for cities than their accounted direct and indirect emissions combined. To give some concrete examples:

- Cities such as New York and London often attribute (and celebrate) their relatively low use of energy to the efficiency of heating dense multifamily buildings. But when you add the Scope 3 emissions from consuming goods and services in these cities, as well as the climate consequences of investments made from these financial centers, this significantly increases their carbon emissions and provides a more complete picture of the environmental impact of urbanization.

- Similarly, relatively low energy usage in the E.U. or Japan would be much higher if they accounted for the emissions related to their consumption of goods manufactured in China and other countries, and the relatively high GHG emissions of the U.S. would be even higher.

- Finally, even if MIT uses less energy to create knowledge or educate students than a large steelmaker uses to make steel, we still create substantial global GHG emissions by consuming purchased goods and services that stimulate GHG emissions elsewhere, including food, materials, business travel, and the production of waste.

Many universities have begun to account for and address their Scope 3 emissions, including Yale, Princeton, Penn, and UCLA, though these efforts are not yet complete. SA+P can, by example, encourage MIT to join these efforts at accountability and action; through its research and lab work, it can bring cities to this level of climate action as well.

Analysis of GHG Emissions

Data sources

Like many universities, MIT centralizes the provision of utilities -- electricity, steam, chilled water, and natural gas, as well as phone lines, high-speed Internet, data storage, and other energy-intensive services. As a result, individual schools, departments, faculty, and students are often completely unaware of their energy use. GHG emissions are highly variable even within SA+P in the various DLCs. We worked with the MIT Office of Sustainability (MITOS) to obtain Scope 1, 2, and 3 data, mapping by building, departmental square footage, and consumption activities for the fiscal year 2019, the last year before the coronavirus pandemic. Data sources are discussed below in each category or scope.

SA+P Scope 1 and 2 emissions

Our best estimates for Scope 1 and 2 emissions in FY 2019 are that:

- SA+P buildings comprise 3% of MIT's total assignable building area, as well as approximately 3% of MIT's total Scope 1 and 2 emissions.

- MIT's Scope 1 and 2 GHG emissions were allocated to SA+P according to the specific GHG intensity (metric tons of carbon dioxide equivalent -- or MTCO2e -- per total assignable square foot) of each building multiplied by the square footage assigned to its DLCs in each building.

- In 2019, from buildings and energy use alone, SA+P emitted approximately 6,045 MTCO2e and

- Averaging across SA+P's 1,247 faculty, students, and staff, this is equivalent to 4.8 MTCO2e per person per year.

This estimate of SA+P building emissions was calculated from MIT's purchased electricity (Scope 2 emissions) and natural gas (Scope 1 emissions), which is used to produce steam, chilled water, and additional electricity. The emissions data associated with building energy use were obtained from MITOS and facilities, using data from building meters and calculated as MTCO2e for fiscal year 2019 (July 1, 2018 - June 30, 2019). Data about building energy use can also be accessed directly through MITOS's Energize MIT platform.

The SA+P occupies space in nine buildings: 3, 5, 7, 9, 10, E14, E15, E18 and N51. However, since SA+P shares all of the buildings with other schools and departments, and the data is based on whole-building energy use, the amount of GHG assigned to SA+P is proportional to the square footage we occupy in the building (not including common spaces such as Dome 7). As such, the data for Scope 1 + 2 are not particularly representative of SA+P's specific activities and their related GHG emissions. In addition, because SA+P does not own dedicated vehicles and does not use large amounts of specialty research or process gases, we have not included these standard GHG source components of MIT's GHG inventory as part of our spreadsheets or visualizations, nor do those inform the action plan.

SA+P Scope 3 emissions

Our best estimates are that SA+P's Scope 3 emissions in FY 2019:

- comprise 18,750 MTCO2e;

- averaged across the 1,247 faculty, staff, and students, this is equivalent to 15 MTCO2e per person per year; and

- comprises 75% of SA+P total GHG emissions.

Scope 3 emissions are therefore 3 times larger than SA+P's Scope 1 and 2 emissions.

Scope 3 emissions extend to SA+P's consumption activities both off-campus and on. We have estimated and categorized our Scope 3 emissions based on available data obtained from the MIT VP for Finance, SA+P Dean's Office, and Scope 3 studies that MITOS has been conducting since 2018. However, due to limitations of how data is collected and aggregated at MIT, the Scope 3 emissions we discuss here are not complete because all aspects of our Scope 3 activities are not yet fully accounted for (e.g., commuting by car). The most recent year for available emissions is used, which ranges from FY16 to FY19.

GHG emissions are calculated using a process-based life cycle assessment (LCA) approach in some cases, which uses quantities of consumption as a basis for calculation (e.g., amount of natural gas or electricity consumed). In other cases, an environmentally-extended input-output (EEIO) LCA approach is used, which is based on dollars spent that are then tied to environmental emissions in sectors of the economy.

The outline below shows the main categories of Scope 3 emissions and their data sources:

3.1. Purchased goods (data on services not available)
Examples: food, office supplies, computers.
Data sources: FY16 VPF office data on spending on goods only (representing about 18% of all of MIT's spending) for all of MIT, analysis by Rachel Perlman in her PhD thesis.[1]
Approach: MIT emissions allocated to SA+P using SA+P population fraction.

3.2. Capital goods (building construction only)
Examples: building construction and renovation, equipment.
Data sources: FY16 construction spending data from the Department of Facilities.
Approach: MIT emissions allocated to SA+P using SA+P population fraction.

3.3. Fuel/energy-related activities
Examples: upstream GHG emissions associated with extraction, refinement, and distribution of energy sources including natural gas and electricity; these are not accounted for in Scopes 1 and 2.
Data sources: FY19 Scope 1 and 2 emissions for SA+P from MITOS, based on GHG intensity of SA+P occupied space.

1 Perlman, R.M.K. (2020). Characterizing the Materials Footprint of a University Campus: Data, Methods, and Recommendations. [Dissertation, Massachusetts Institute of Technology].

3.5. Waste
Examples: the burden of collecting and treating trash, recycling, and compost streams, plus credits for avoided burdens of producing virgin materials when materials are recycled (which is why the number can be negative).
Data sources: FY16 waste data from MITOS.
Approach: MIT emissions allocated to SA+P using SA+P population fraction.

3.6. Business travel
Examples: travel for conferences, practica, studios, and donor engagement; includes air travel, lodging, meals, and ground transportation.
Data sources: FY19 VPF office data from travel reimbursements, via Concur.
Approach: travel reimbursement spending is tied to DLCs via their association with the cost object used in the reimbursement form.

3.7. Employee commuting
Examples: Commuting to campus by faculty, staff, and students.
Data sources: FY16 analysis of commuter survey data from the Office of Parking and Transportation by MITOS.
Approach: MIT emissions allocated to SA+P using SA+P population fraction.

3.13. Downstream leased assets
Examples: Energy consumption by buildings in the MITIMCO portfolio. The revenue from these leases fund activities on MIT's campus.
Data sources: FY17 analysis of data from the City of Cambridge.
Approach: MIT emissions allocated to SA+P using SA+P population fraction.

Per capita GHG emissions for comparison

We provide a few other figures to enable comparison of SA+P to regions and countries:

Institution, political unit (mostly Scope 1 and 2 only)	GHG emissions (MTCO2e per capita)	Source
Kenya	0.4	World Bank
India	1.8	World Bank
MIT/SA+P, Scope 1 and 2	**4.8**	**MITOS Calculation**
World average	5.0	World Bank
China	7.1	World Bank
Germany	8.8	World Bank
Massachusetts	10.7	MassDEP 2017 GHG inventory with 6.9M ppl.
MIT/SA+P, Scope 3	**15.0**	**MITOS Calculation**
United States	15.5	World Bank
MIT/SA+P, Total Scope 1, 2, 3	**19.8**	**Summary from MITOS Calculation**

Table 2.2

Analysis at the DLC Level

The following section provides breakouts of the total calculated SA+P Scope 1, 2, and 3 GHG emissions by each department, lab, and center, also known as DLCs at MIT. The main DLCs in SA+P are:

- The Media Lab (ML) and the Program in Media Arts and Sciences (MAS)
- The Department of Architecture (Arch)
- The Department of Urban Studies and Planning (DUSP)
- Center for Real Estate (CRE)
- Office of the Dean (Dean)
- Program in Art, Culture, and Technology (ACT)
- Leventhal Center for Advanced Urbanism (LCAU)

This section will show some basic figures and tables that organize GHG emissions by DLC, and then we will discuss the contributors to those emissions, by each DLC unit of SA+P. Following that will be graphic representations of the data that make disparities visually evident.

Total GHG Emissions by DLC

Breakdown by Main DLCs

Emissions Category (Scope.subcategory)	ML + MAS	DUSP	Arch	CRE	Dean	ACT	LC AU	Total SA+P	%	Notes
1. Direct emissions	1,239	1,068	925	179	444	290		4,145	*17%*	%MIT,SA+P area
2. Indirect electric emissions	1,018	134	244	15	237	252		1,900	*8%*	%MIT,SA+P area
3.1. Purch. goods & services	1,542	1,006	1,171	184	45	65	19	4,032	*16%*	%MIT,SA+P ppl
3.2. Bldg, facilities cons.	1,690	1,102	1,282	202	50	71	21	4,417	*18%*	%MIT,SA+P ppl
3.3. Fuel-related activities	994	414	447	66	294	242		2,456	*10%*	%MIT,SA+P area
3.5. Waste	-54	-35	-41	-6	-2	-2	-1	-140	*-1%*	%MIT,SA+P ppl
3.6. Business travel	2,595	704	683	40	162	46		4,230	*17%*	Concur data
3.7. Employee commuting	554	361	420	66	16	23	7	1,448	*6%*	%MIT,SA+P ppl
3.13. MITIMCo leased assets	883	575	670	105	26	37	11	2,307	*9%*	%MIT,SA+P ppl
Scope 1 (direct)	1,239	1,068	925	179	444	290		4,145	*17%*	Sum
Scope 2 (indirect)	1,018	134	244	15	237	252		1,900	*8%*	Sum
Scope 3 (consum./waste)	8,204	4,126	4,632	658	591	481	58	18,750	*76%*	Sum
TOTAL GHG	10,461	5,328	5,801	852	1,272	1,023	58	24,795	*100%*	Sum
DLC % of SA+P total (GHG):	*42%*	*21%*	*23%*	*3%*	*5%*	*4%*	*0%*	*100%*		
Total faculty, staff	284	109	103	18	14	10	6	544	*44%*	SA+P Dean's office
Total students	193	202	259	39		10		703	*56%*	MIT Registrar
TOTAL PEOPLE	477	311	362	57	14	20	6	1,247		
DLC % of SA+P total (People)	*38%*	*25%*	*29%*	*5%*	*1%*	*2%*	*0%*	*100%*		
TOTAL SQUARE FOOTAGE	99	32	36	5	22	27	0	220		MIT Bldg Space Inventory
DLC % of SA+P total ('000 SF	*45%*	*15%*	*16%*	*2%*	*10%*	*12%*	*0%*	*100%*		

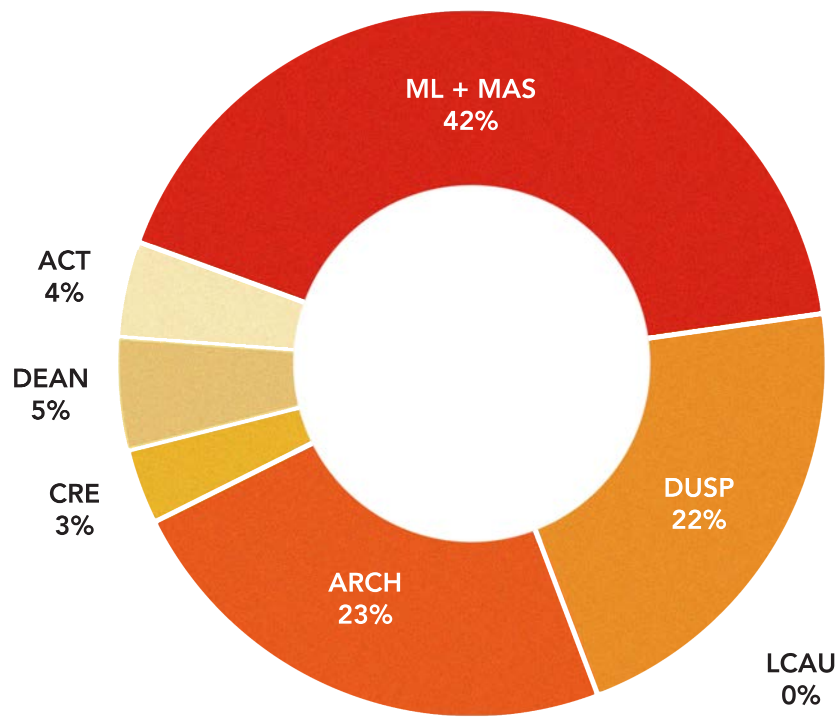
Notes:

For categories 3.1, 3.2, 3.5, 3.7, and 3.13, portion of MIT and SA+P total is attributed to DLCs based on population.

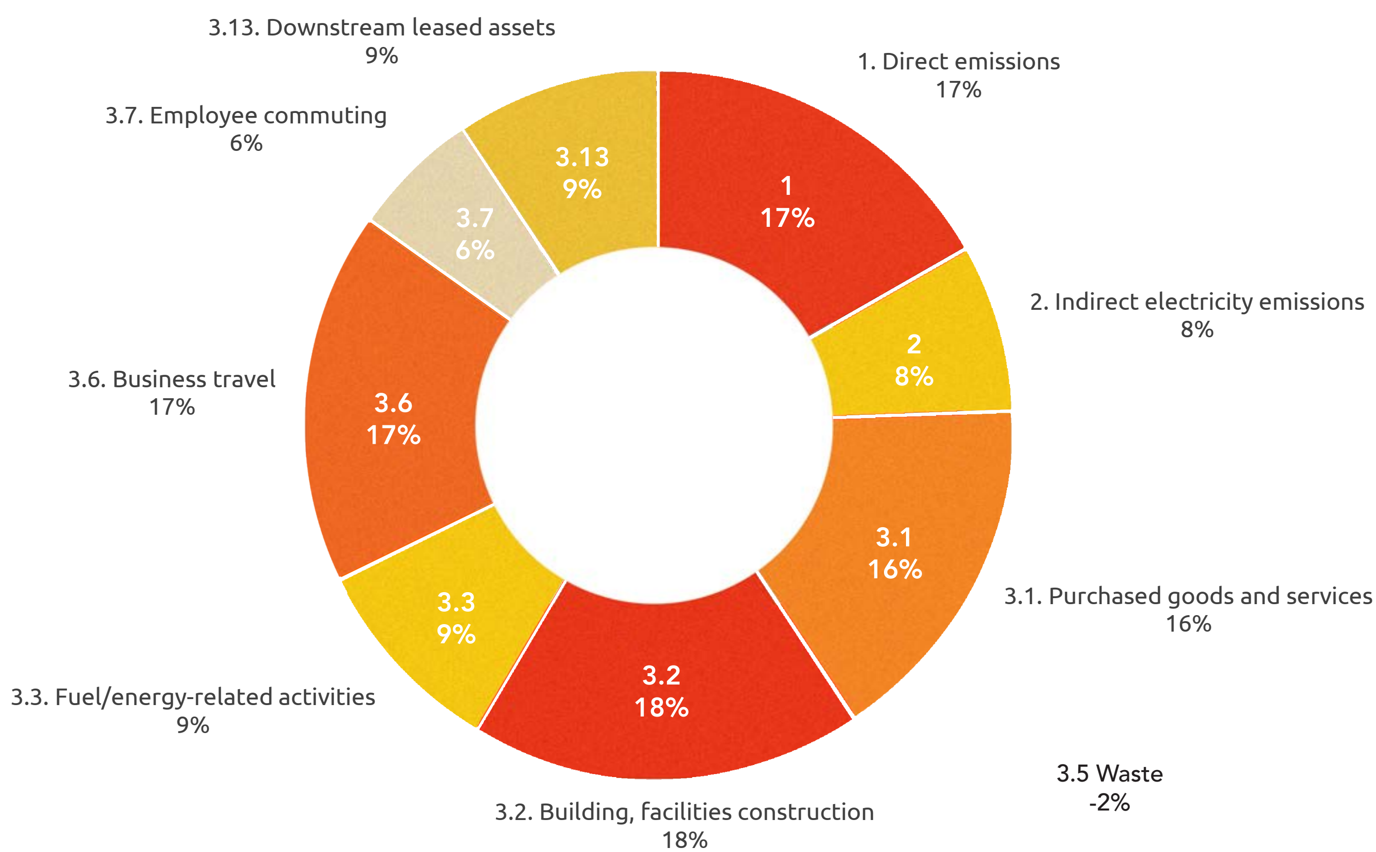
For categories 1, 2, 3.3, and 3.6, the numbers were estimated at the SA+P DLC level and then summed.

Table 2.3

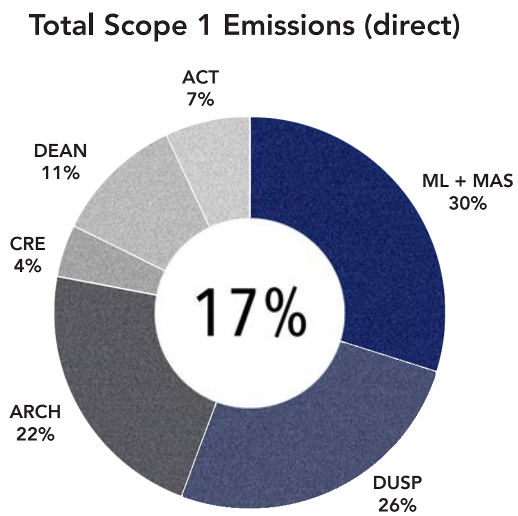
Total GHG Emissions by DLC (Scope 1, 2 & 3)



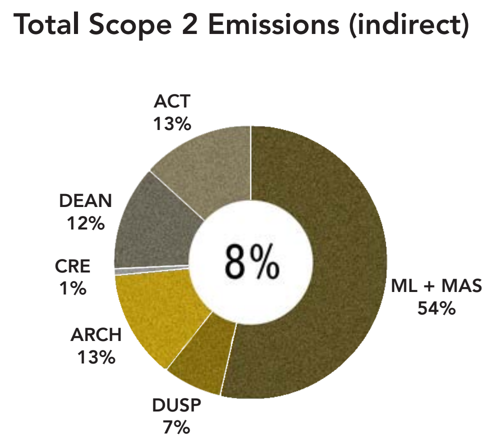
Total GHG Emissions by Category Breakdown (Scope 1, 2 & 3)



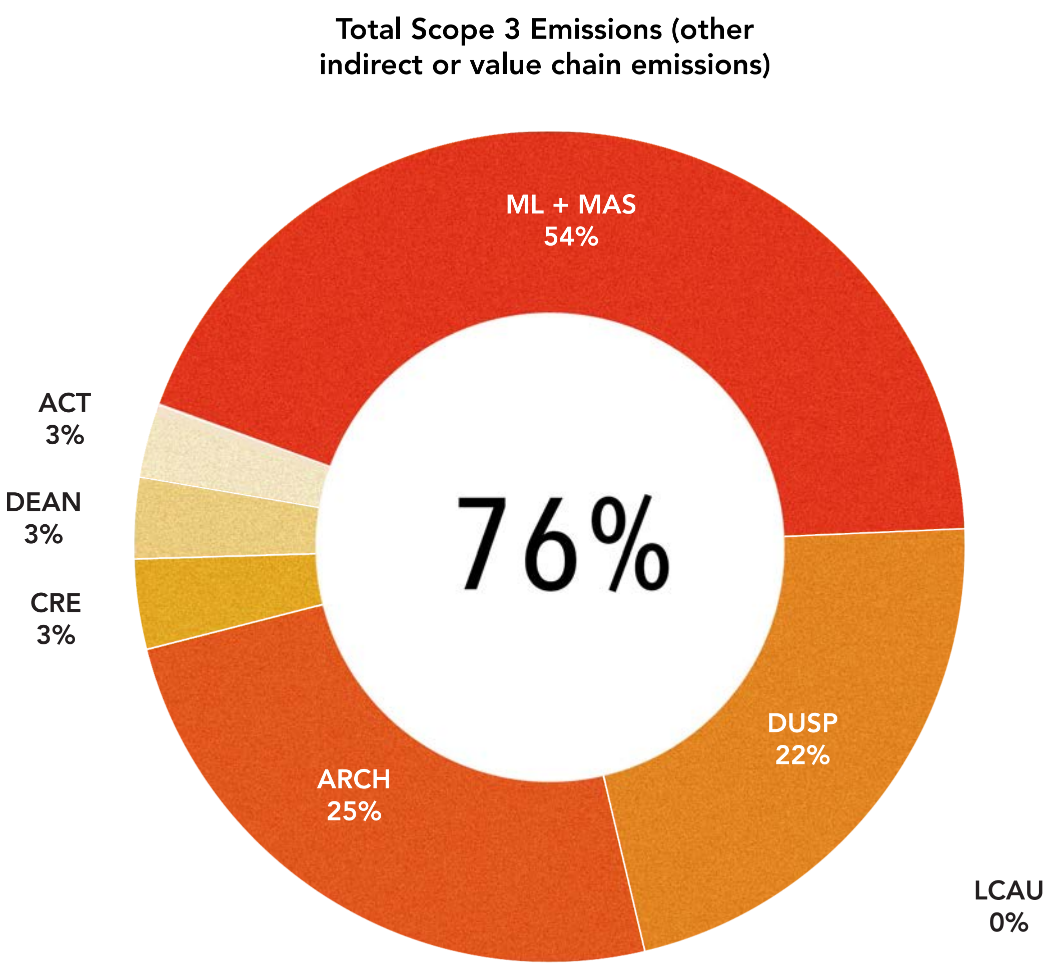
Total GHG Emissions by DLC



Scope 1 emissions represent 17% of SA+P Total GHG Emissions



Scope 2 emissions represent 8% of SA+P Total GHG Emissions



Scope 3 emissions represent 76% of SA+P Total GHG Emissions

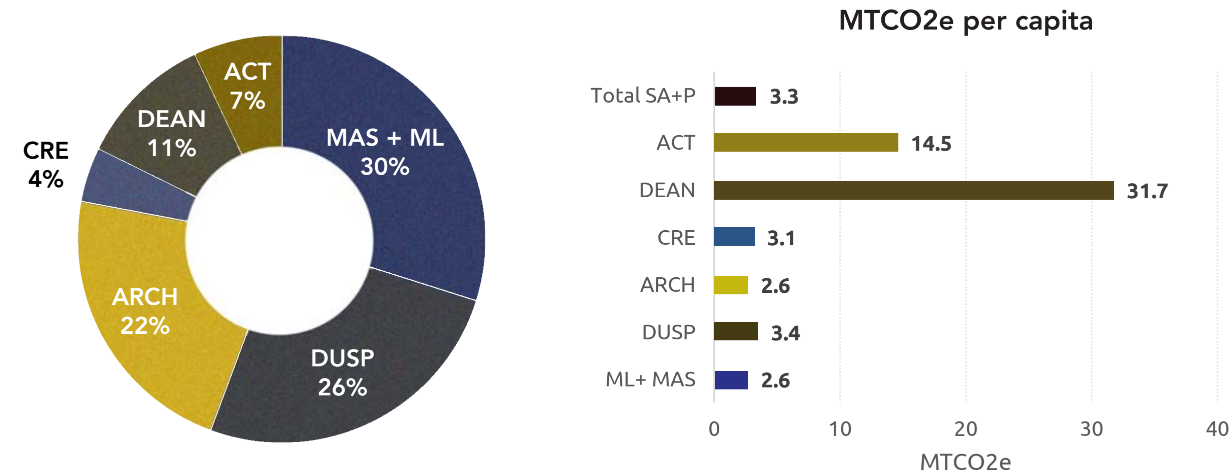
Breakdown of GHG emissions within each DLC

Emissions Category (Scope.subcategory)	**ML+ MAS**	**DUSP**	**Arch**	**CRE**	**Dean**	**ACT**	**LCAU**	**Total SA+P**	***% of Total***
1. Direct emissions	12%	20%	16%	21%	35%	28%	0%	17%	*17%*
2. Indirect electricity emissions	10%	3%	4%	2%	19%	25%	0%	8%	*8%*
3.1. Purchased goods and services	15%	19%	20%	22%	4%	6%	33%	16%	*16%*
3.2. Building, facilities construction	16%	21%	22%	24%	4%	7%	37%	18%	*18%*
3.3. Fuel/energy-related activities	10%	8%	8%	8%	23%	24%	0%	10%	*10%*
3.5. Waste	-1%	-1%	-1%	-1%	0%	0%	-1%	-1%	*-1%*
3.6. Business travel	25%	13%	12%	5%	13%	4%	0%	17%	*17%*
3.7. Employee commuting	5%	7%	7%	8%	1%	2%	12%	6%	*6%*
3.13. Downstream leased assets	8%	11%	12%	12%	2%	4%	19%	9%	*9%*
Scope 1 (direct)	12%	20%	16%	21%	35%	28%	0%	17%	*17%*
Scope 2 (indirect)	10%	3%	4%	2%	19%	25%	0%	8%	*8%*
Scope 3 (consum./waste)	78%	77%	80%	77%	46%	47%	100%	76%	*76%*
TOTAL GHG	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*

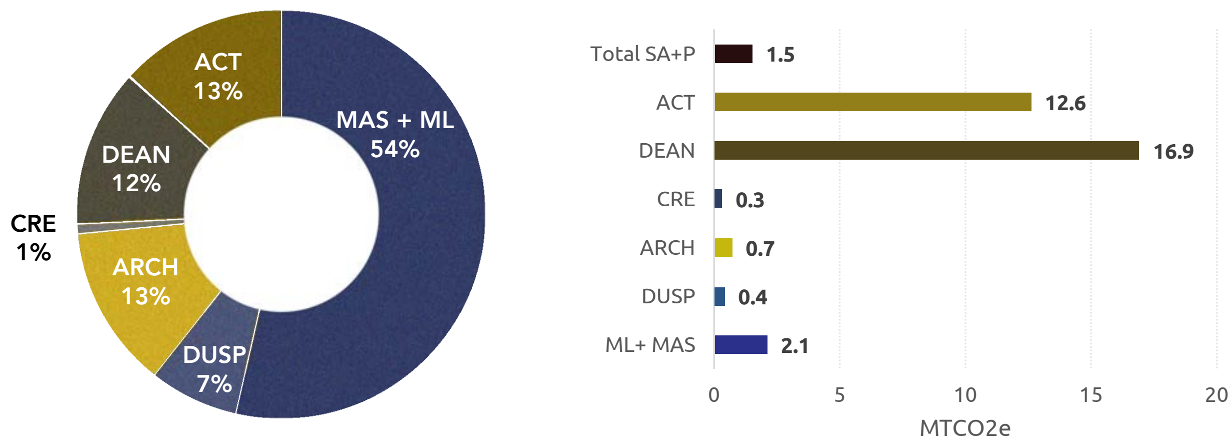
Table 2.4

Breakdown of GHG emissions within each DLC

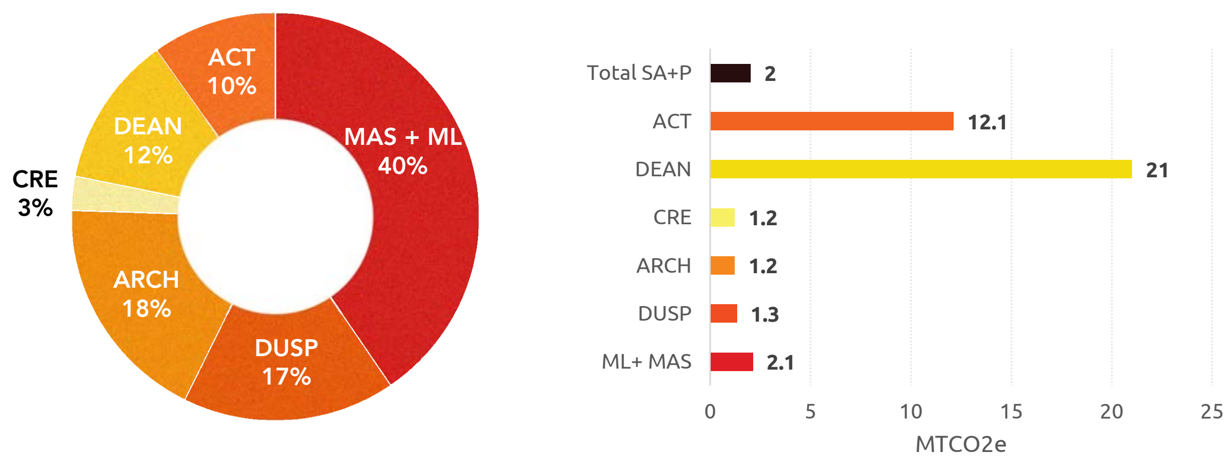
Scope 1. Direct Emissions



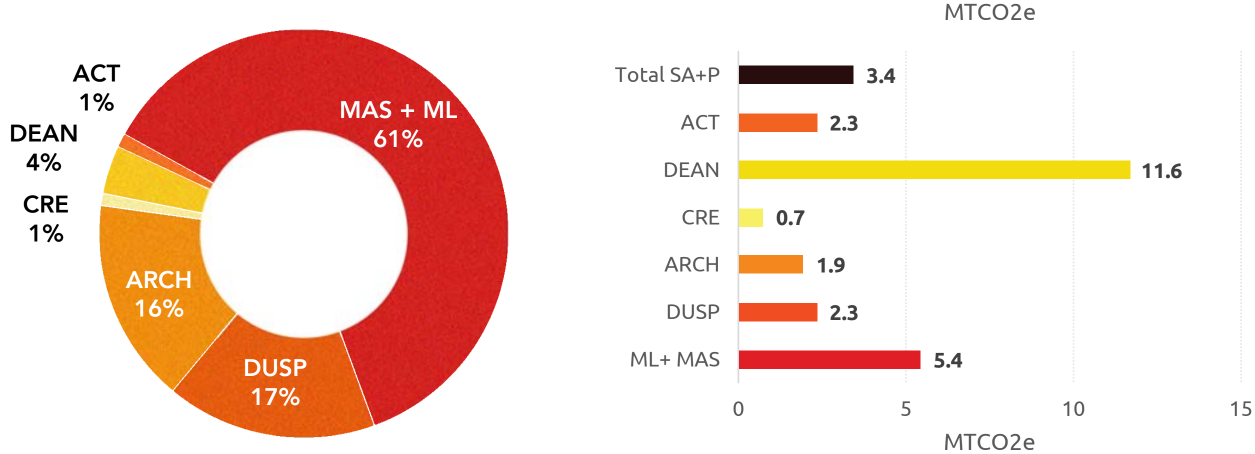
Scope 2. Indirect Electrity Emissioons



Scope 3.3 Fuel and Energy-related activities



Scope 3.6 Business Travel

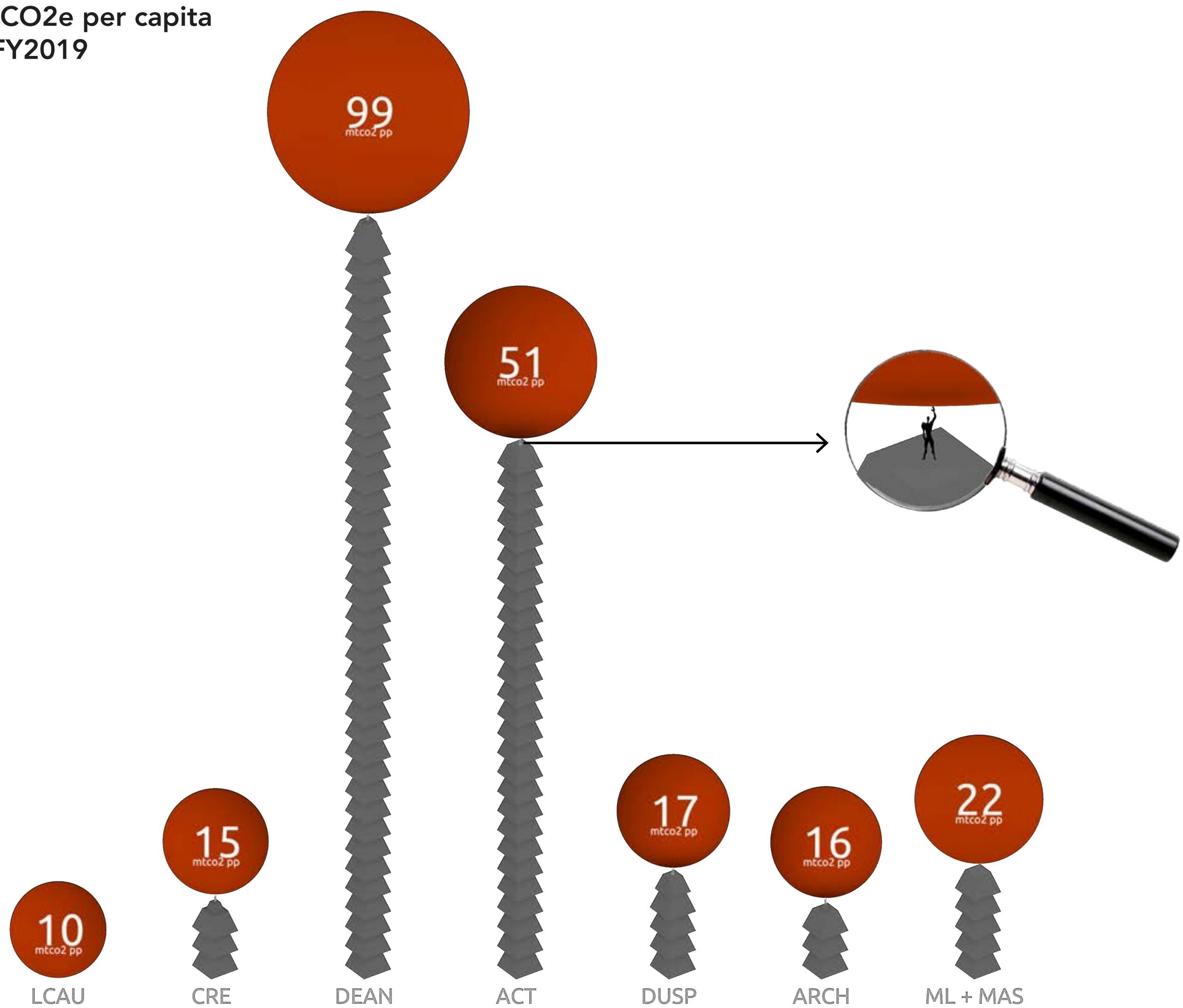


GHG emissions in each DLC by number of people

PER CAPITA EMISSIONS	ML+ MAS	DUSP	Arch	CRE	Dean	ACT	LCAU	Total SA+P
1. Direct emissions	2.6	3.4	2.6	3.1	31.7	14.5	0.0	3.3
2. Indirect electricity emissions	2.1	0.4	0.7	0.3	16.9	12.6	0.0	1.5
3.1. Purchased Goods and services	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
3.2. Capital goods	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
3.3. Fuel and energy-related activities	2.1	1.3	1.2	1.2	21.0	12.1	0.0	2.0
3.5. Waste	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
3.6. Business Travel	5.4	2.3	1.9	0.7	11.6	2.3	0.0	3.4
3.7. Employee commuting	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
3.13. Downstream leased assets	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
DLC % of SA+P total (People):	38%	25%	29%	5%	1%	2%	0%	100%

Table 2.5

MTCO2e per capita in FY2019



Discussion of GHG Emissions Within Each DLC

Media Lab (ML) and the Program in Media Arts and Sciences (MAS)

We estimate that the Media Lab and the Program in Media Arts and Sciences together comprise the largest portion of SA+P's emissions at 42% of the GHG emissions of the entire school. Part of this is driven by ML/MAS possessing the largest square footage, since this unit constitutes an unusually large portion of SA+P's total area (45%) and includes a large number of faculty and staff. GHG emissions from business travel is the largest single category (2,595 MTCO2e) of emissions and constitutes fully one-quarter (25%) of the Media Lab's total annual GHG emissions and one-tenth of the entire SA+P carbon budget.

Department of Architecture (Arch)

We estimate that the Department of Architecture constitutes 23% of SA+P's emissions. The largest contributions to the department's total emissions are:

- building, facilities construction (1,282 MTCO2e, or 22% of total Arch GHG emissions)
- purchased goods and services (1,171 MTCO2e, or 20% of the total)
- direct building emissions (925 MTCO2e, or 16% of the total)
- business travel (683 MTCO2e, or 12% of the total)
- employee commuting (420 MTCO2e, or 7% of the total)*

Department of Urban Studies and Planning (DUSP)

We estimate that the Department of Urban Studies and Planning constitutes 21% of SA+P's emissions. The largest contributions to the department's total emissions are:

- building, facilities construction (1,102 MTCO2e, or 21% of total DUSP GHG emissions)
- direct building emissions (1,068 MTCO2e, or 20% of the total)
- purchased goods and services (1,006 MTCO2e, or 19% of the total)
- business travel (704 MTCO2e, or 13% of the total)
- employee commuting (361 MTCO2e, or 7% of the total)*

Center for Real Estate (CRE)

We estimate that the Center for Real Estate constitutes 3% of SA+P's emissions. The Center has relatively little space compared to the number of faculty and students. The largest contributions to the program's total emissions are:

- building, facilities construction (202 MTCO2e, or 24% of total CRE GHG emissions)
- purchased goods and services (184 MTCO2e, or 22% of the total)
- employee commuting (66 MTCO2e, or 8% of the total)*

Office of the Dean (Dean)

We estimate that the Office of the Dean constitutes 1.1% of SA+P's emissions. Note that there are relatively few staff and no students in this office, yet GHG totals are affected by a large allocation of space in Building 7, and significant travel. The largest single contribution to the office's total emissions are:

- direct emissions (444 MTCO2e, or 35% of the office's total GHG emissions)
- indirect emissions from electricity (237, or 19% of the total)
- fuel or energy-related activities (294 MTCO2e, or 23% of the total)
- business travel (162 MTCO2e, or 13% of the total)*

Program in Arts, Culture, and Technology (ACT)

We estimate that the Program in Arts, Culture, and Technology (ACT) constitutes 4% of SA+P's emissions. The largest contributions to the program's total emissions are related to its relatively large footprint, and certain facilities that are run on a 24/7 basis:

- direct building emissions (290 MTCO2e, or 28% of the program's total GHG emissions)
- indirect electricity emissions (252 MTCO2e, or 25% of the total)
- fuel and energy-related activities (242 MTCO2e, or 24% of the total)*

Leventhal Center for Advanced Urbanism (LCAU)

We estimate that the Leventhal Center for Advanced Urbanism constitutes 0.2% of SA+P's emissions. Note that the office officially occupies no space in the MIT Building Space Inventory, so does not have any attributed direct or indirect emissions, or emissions from fuel-related activities. The largest single contribution to the office's total emissions are:

- building, facilities construction (21 MTCO2e, or 37% of total LCAU GHG emissions)
- purchased goods and services (19 MTCO2e, or 33% of the total)*

*Only largest percentages are included in these breakdowns.

SECTION 3. RECOMMENDATIONS FOR ACTION IN SA+P AND DLCs

Framework for SA+P, DLC Decision-making

This section proposes a number of ways for SA+P and DLCs to take climate action. Framing our actions, however, requires distinguishing between programs and decisions that are made at a MIT-wide level and those that are within the control of SA+P and its constituent DLCs. Like most universities, some programs and services are centralized while others are under school or departmental control.

The table below (Table 3.1) shows a rough breakdown between how categories of GHG emissions are made: whether at the Institute or school or department level. At the Institute-level, we can advocate or offer to lead the Institute in new pilot programs, especially ones that build or follow on existing efforts and programs. This also puts a particular focus on our future choices about where we situate ourselves in the Institute, in particular regarding the MET Warehouse.

At the SA+P or DLC level, we have more latitude and control to use our budget and administrative capabilities to direct or incentivize our behavior and choices.

Category of GHG emissions	MIT	SA+P, DLCs
1. Direct emissions	X	
2. Indirect electricity emissions	X	X
3.1. Purchased goods and services		X
3.2. Building, facilities construction	X	X
3.3. Fuel and energy-related activities	X	
3.5. Waste	X	X
3.6. Business Travel		X
3.7. Employee commuting	X	X
3.13. Downstream leased assets	X	

Table 3.1

University-wide Decisions

As one of the six schools and colleges that comprise the Institute, we have considerable influence to advocate for changes, especially since our core research and advisory role on Institute committees often bears directly on decisions made with regards to the campus facilities and built environment.

It is expected that the Institute in the fall of 2020 will address the campus direct emissions (Scope 1), indirect electricity emissions (2), and fuel and energy-related activities (3.3), through a campus-wide power purchase agreement (PPA) or the building of new renewable assets that will offset the Institute's existing Scope 1 and 2 carbon emissions.

For the category of building and facilities construction (3.2), SA+P is obviously the anchoring tenant for the MET Warehouse, actively engaged in design and renovation of this unconventional 19th century building. Given the relative paucity of renewable resources available for this building, since it is located in a dense urban fabric in the not-too-sunny Northeastern region of the US, SA+P should advocate for renovation of the MET Warehouse to:

- Remain as energy efficient as possible, to reduce its use of energy resources.
- Preserve the option of switching its remaining energy use to renewable resources.

For our share of downstream leased assets (3.13), we recommend that SA+P should advocate for MITIMCO to consider and implement carbon-free strategies as a major owner, operator, and investor in real estate in the Cambridge and Kendall Square area. Possible policies to advocate for are:

- For the power purchase agreement signed by MIT also to cover its downstream leased assets with MITIMCO.
- Upgrading of downstream leased assets to emphasize energy efficiency and pathways to carbon neutrality.

This topic has already been studied by multiple groups in DUSP and Architecture, particularly in an ESI-sponsored research project on the Volpe Center redevelopment by Professors Norford, Reinhart, and Hsu.

Actions for SA+P on Scope 1 and 2 Emissions

Specific action areas where SA+P could advocate for pilot programs are:

1. Reduce "Vampire energy use" – Choose specific office suites in building 7 and 9 and install enhanced power strips and plug monitors to increase awareness of Plug and Process loads (PPLs), which can reduce building energy use.

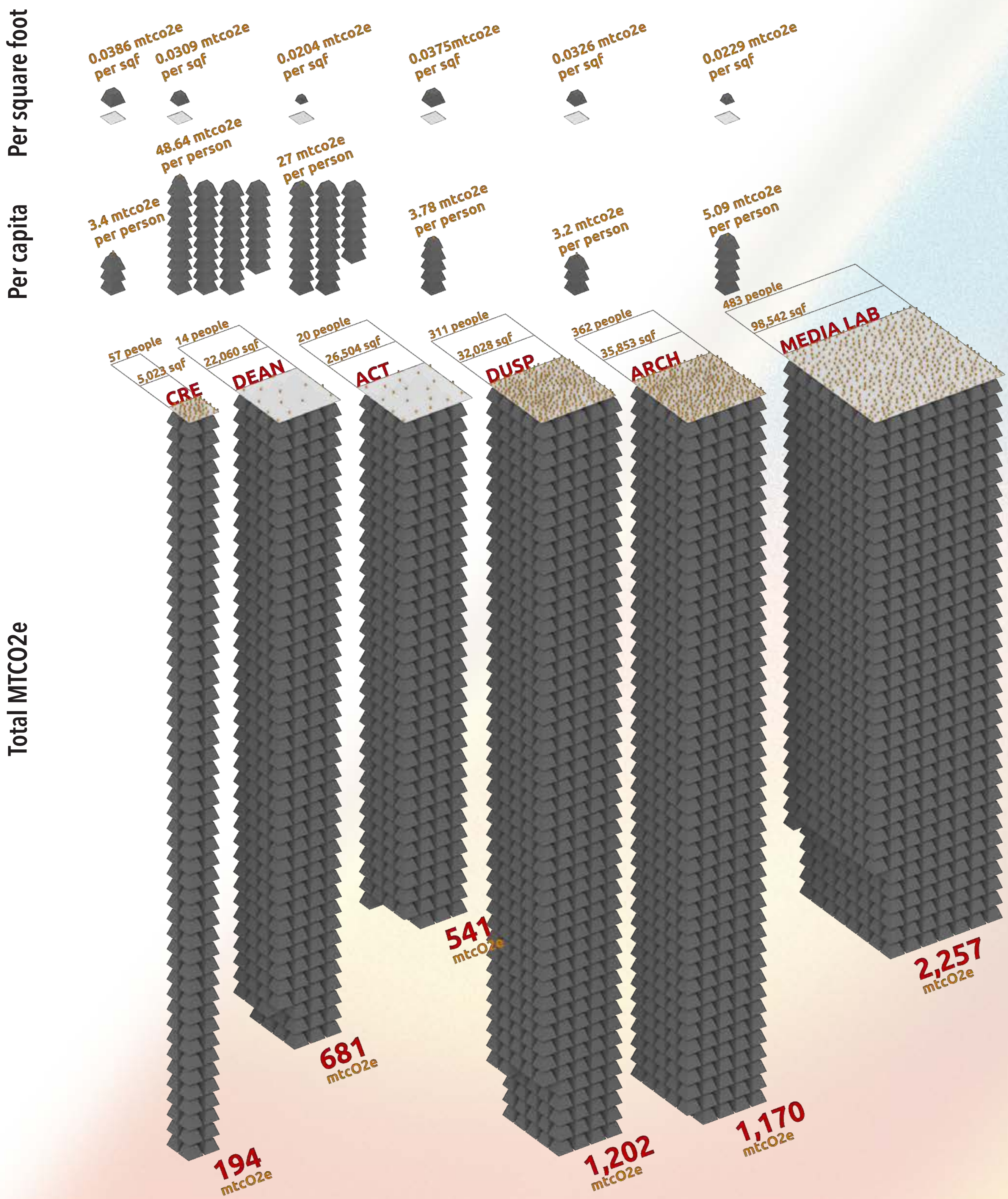
2. Reduce HVAC utilities use -- DLCs can prioritize educating occupants that central control of thermostats will be tried in selected office suites, with voluntary thermostat controls in others. Engage in friendly competition to see whose areas draw less from the chilled water/ steam heat generated by MIT's fossil-fuel-based co-generation plant.

3. Use hallway screens as "dashboards" – DLCs can support innovative interfaces for monitoring energy use in specific labs, classrooms, and offices. Periodic data feeds can be broadcast on hallways screens to incite friendly competition for lower energy use.

4. Positive incentivizing – Post-coronavirus, DLCs can deposit $1K (or representative amount of MIT facilities savings) into lab and center budgets when benchmarks are achieved, or into individual faculty accounts when first-place energy reductions are achieved.

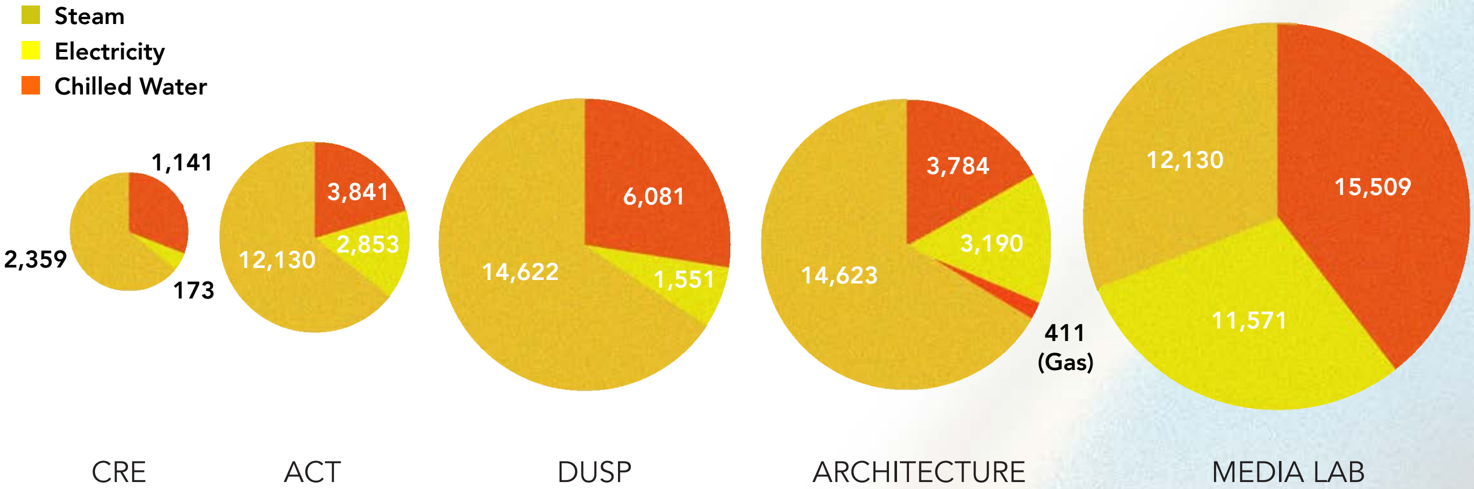
5. Design competition – DLCs can host a design competition to make the core staircase in Building 3 more enticing than the elevator, and make the building 7 elevator encourage taking the stairs.

SA+P building energy use emissions, total and per capita

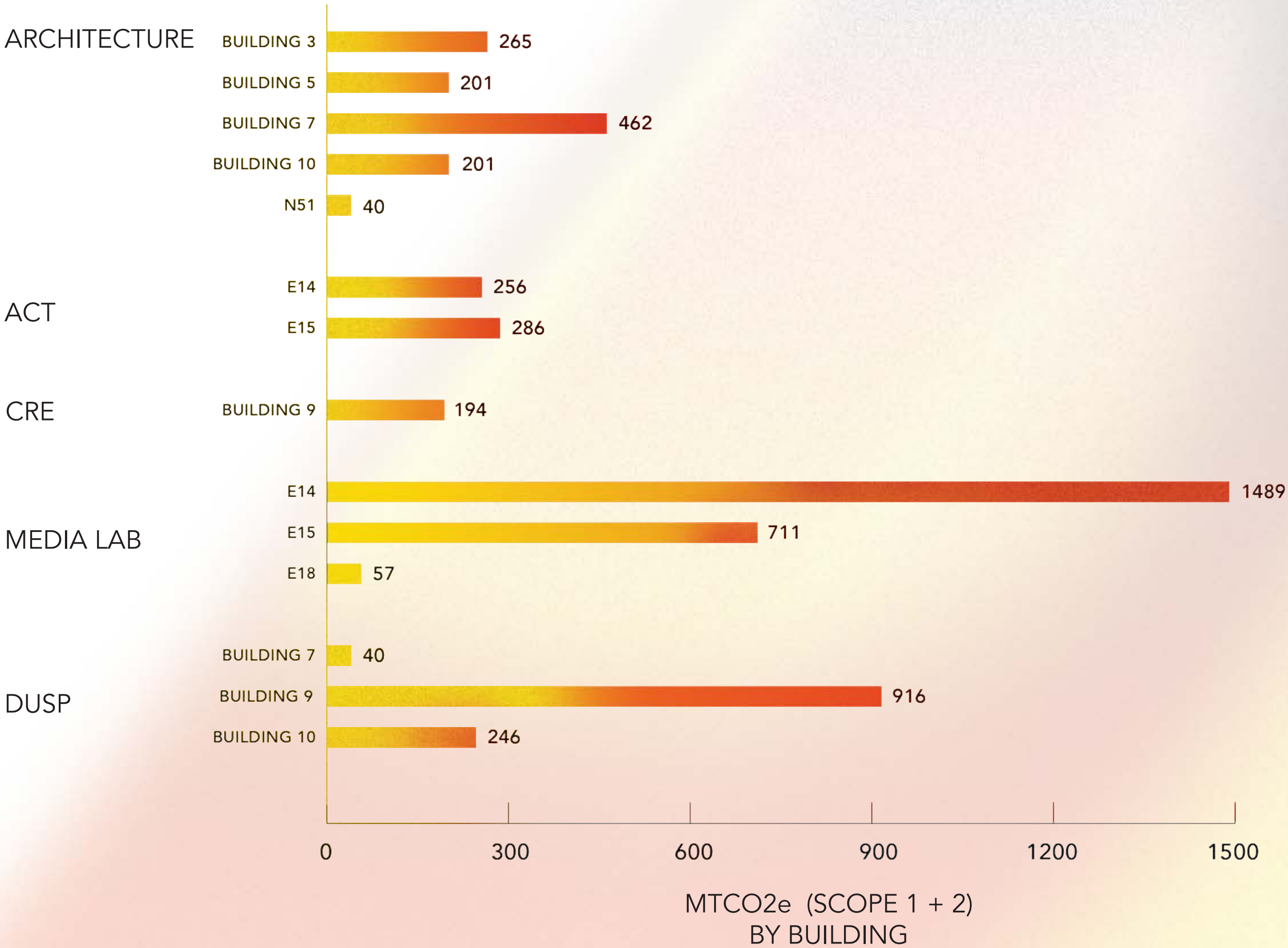


Building energy use by utility

SA+P Building Energy Use Total: 96,570 MMBTU
Unit: MMBTU / One million british thermal units



Emissions by building



Actions for SA+P on Scope 3 Emissions

Purchased goods

Some of the large categories of purchased goods in SA+P include office supplies, computers and electronics, supplies for studio and other lab activities, and food. The carbon emissions of all of these categories could be reduced by the following steps:

1. Better assess where the main GHG emissions come from SA+P and DLC purchasing.

2. Development of a preferred vendor list of green-certified or carbon-neutral operations, including catering. For example, all Apple products will become carbon-neutral in the near future; Flour uses only compostable materials in its meal services, etcetera.

3. Identify largest SA+P vendors and convert to those that design out waste through extended producer responsibility such as leasing or rental of equipment, shared equipment across DLCs and vendor take-back programs for aging equipment.

4. More efficient purchasing, for example through bulk or centralized ordering, as DUSP does when ordering food for all of its departmental meetings.

5. Design out recycling contamination by eliminating common contaminants from the purchasing/input stream. Prior to the COVID-19 campus closure, a baseline waste audit of 172 recycling bins in SA+P revealed that 114 (66%) were contaminated with items that do not belong. Fully 80% of the contamination was from coffee cups, used napkins, food containers, utensils and straws.

6. Before making any purchase, DLCs should be incentivized to check Rheaply for free surplus goods available on campus; MIT Rheaply https://axm.rheaply.com/

7. Work with SA+P vendors and MIT sourcing to establish preferred purchasing pricing and menus grounded in sustainability considerations for most common SA+P purchasing categories and products. Ask vendors (i.e. Staples) to track and report sustainable spending by SA+P DLCs, and to identify opportunities for growing sustainable spending to 80% or greater for overall DLC consumption.

8. Challenge SA+P community to come up with more ideas to reduce consumption.

9. Challenge SA+P DLCs to go plastic-free.

Waste

DUSP had planned to conduct a waste pilot with MITOS this spring, which was unfortunately interrupted by COVID-19 and the evacuation from campus.

1. Campus-wide System Pilot Test of MIT Rheaply https://axm.rheaply.com/:

Third-party circular asset management tool, Rheaply, was rolled out across the entire campus in 2019. Can SA+P incentivize DLC engagement with this tool? The tool matches surplus items with those in need across campus. It facilitates reuse of items (office and lab equipment) that would have otherwise been discarded. This actively addresses the material flow analysis (MFA) finding that office furniture is our third most greenhouse gas emissions intensive category in waste.

2. Building-Scale Pilot Practices to reduce contamination in recycling and food waste:

Extend pilots on waste reduction:

The MIT Media Lab, in partnership with the MITOS and Dept. of Facilities conducted a 2019++ pilot to turn the 300 person Media Lab into a living laboratory for testing infrastructure changes and behavioral impacts. By consolidating and centralizing waste collection stations in the building, providing waste education sessions, regularly monitoring contamination levels and conducting pre and post experiment waste audits, we saw a 6.5% reduction in waste contamination levels of recycling, collection of an additional 2,500 lbs of food waste from office and lab spaces, and a 70% increase in the confidence of participants knowing what waste goes into each bin.

This pilot was extended to additional buildings and departments on campus including the School of Architecture and Planning (SA+P), Center for Computer Science Artificial Intelligence (CSAIL), and one undergraduate dormitory, but the COVID-19 pandemic closed campus and halted launch of this trial.

Implement centralized, visible and consolidated waste collection stations (food waste, recycling, trash) throughout DLC studios and common spaces while eliminating the total number of individual collection bins. This will likely enable more waste to become re-processed for driving a circular economy. Seek guidance from MIT Department of Facilities and MIT Office of Sustainability.

Engage MIT Waste Watchers to 1) train SA+P community in best practices for waste disposal; 2) develop research methods for monitoring contamination levels in recycling and food waste, and provide data feedback loops to the SA+P community for shifting behavior 3) conduct regular waste audits to identify hard-to-recycle items in waste streams that can be designed-out via different procurement decisions

Develop feedback loops with SA+P procurement decisions so that high volume and hard-to-recycle waste items can be designed-out through purchasing guidelines, leasing or rental, vendor take-back programs and other extended producer responsibility opportunities

Business travel

For the spring 2020 meeting with the SA+P school council and within DUSP, we introduced the following menu of options for how to reduce business travel.

1. Developing travel alternatives:

This could involve further developing local, technological, and administrative alternatives for distanced practica, conferences, and research. We are obviously much more advanced in our online methods after six months of COVID-19.

Travel prizes and awards should be reconfigured toward stipend support.

2. Mandatory disclosure and reporting of travel:

All GHG emissions processed by SA+P administration would be recorded and reported in a public database.

This would act as an information disclosure policy, both informing individuals about the consequences of their flying and encouraging social recognition of low-flying behavior.

3. Require buying of offsets with travel expenses

While evidence shows that carbon offsets do not necessarily reduce emissions (since travel does not cease) and have a questionable level of permanence, we could experiment with a requirement that all travel emissions be offset through the buying of carbon offsets, billed along with tickets, to see whether travel is decreased through this price pressure. As with certified vendors (see Purchasing), we would certify the highest-integrity carbon offset program and develop a core relationship with that vendor for MIT.

4. Develop carbon tax and dividend program for SA+P

We could charge high-flying individuals a price for carbon emissions and use this to reward low-or-zero flyers.

This provides a price signal, reward for not flying, as well as increases social awareness of the consequences of flying.

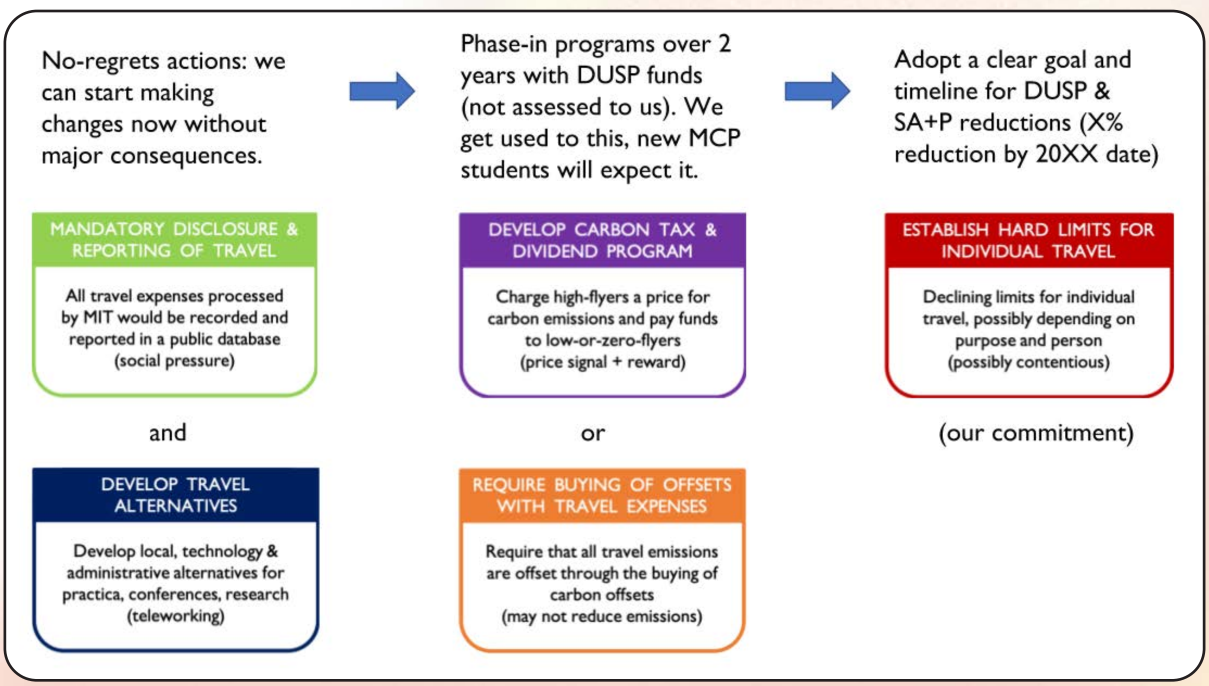
5. Establish a specific mileage budget for business travel for each MIT faculty member:

We could establish limits beyond which travel would no longer be approved for reimbursement. Many universities have phased this in as part of their control of carbon emissions.

Ensure that junior faculty travel budgets are higher, while they are building their professional networks and tenure dossier.

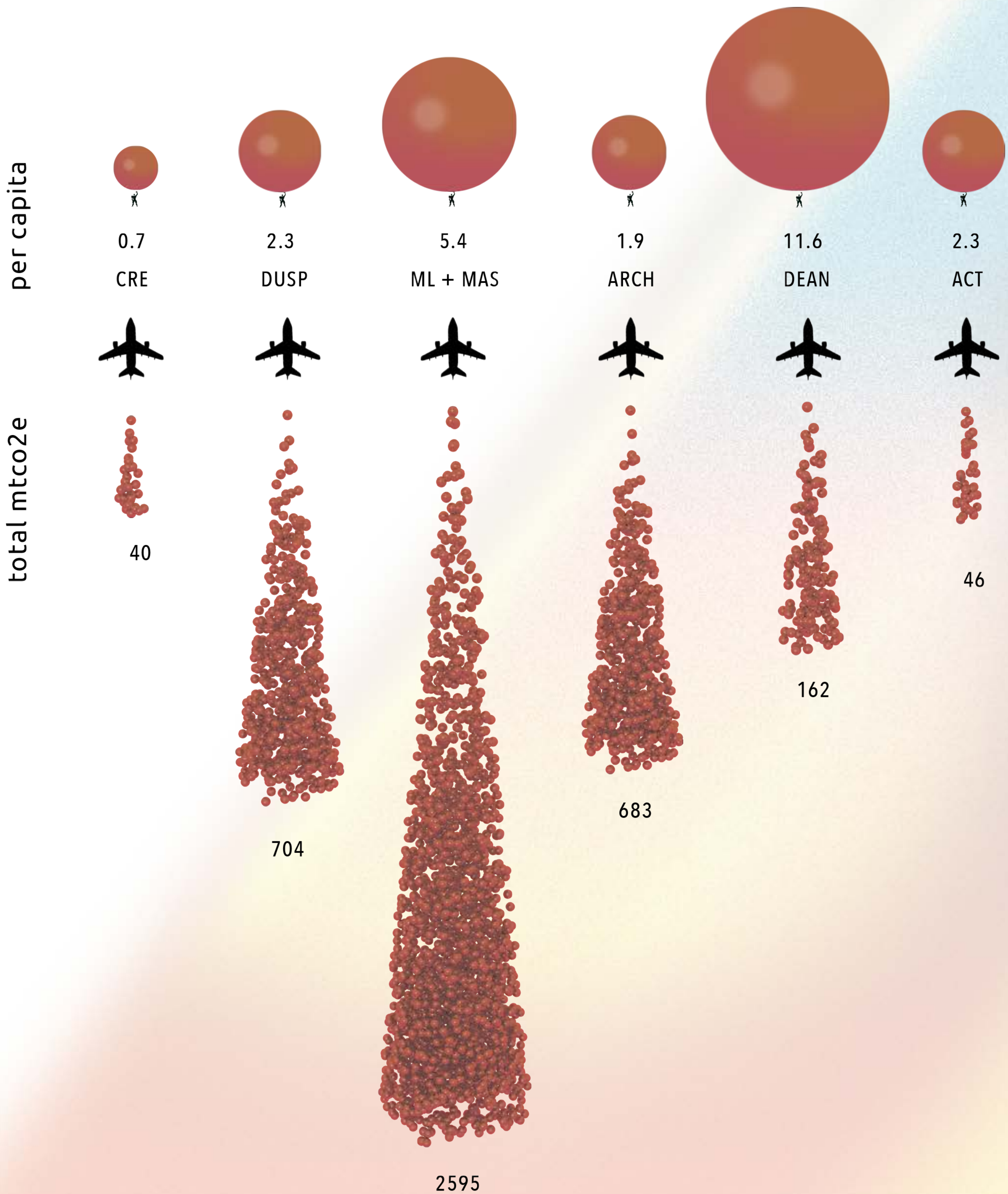
These options could be combined or ordered in different sequences to phase them in, as below:

Experiments & phase-in:



MTCO2e from BUSINESS TRAVEL

(Metric tons of carbon dioxide emissions)



Employee Commuting

There are two major changes that are expected due to COVID. First, a substantial portion of the campus population is obviously working from home, reducing the GHG emissions associated with their trips to work. Second, there may be shifts from existing modes of commuting to new modes, depending on people's willingness to ride public transit.

John Attanucci of the MIT Transit Lab suggested a number of policies to help faculty, staff, and student commuting reduce their carbon impact:

1. Parking cash-out:

The MIT Access program has shifted commuting behavior by providing free transit passes and raising parking costs. During COVID, however, the Institute has waived parking costs because some employees are required to be on campus, and the Institute has not been willing to raise parking prices further.

SA+P or MIT could further incentivize changes in commuting behavior by both raising parking prices and giving an additional cash incentive to everyone, so people who choose not to drive to campus receive an additional subsidy.

This would also be easier to implement during COVID because only a portion of the campus population is required to be on campus, so any parking cash-out program could be started with the small population currently on campus.

2. Free transit passes for students:

Faculty and staff currently receive fully subsidized (free) transit passes from the MIT administration. The MBTA mobility pass program only charges for trips made and makes this a relatively inexpensive benefit for the Institute to provide.

Given that this program already exists at MIT for faculty and staff, based on IDs, adding students to this program would be very easy and straightforward.

This is likely to have a significant effect on student behavior, since they are:
- more price-sensitive than faculty and staff in terms of housing, location, and travel choices;
- probably travel more within areas accessible by transit;
- and end up using ride-hailing services often.

3. Free or subsidized BlueBikes for students:

This program also already exists, allowing faculty, students, and staff to get an annual BlueBike membership for only $25.

Subsidizing this to make it cost less or even free is likely to increase ridership, although one possible obstacle could be a lack of bicycles and docking stations when normal commuting patterns resume.

SECTION 4. PROCESS FOR SA+P CLIMATE ACTION PLAN ADOPTION

We propose the following timeline for the School to adopt this Climate Action Plan:

September 1-14:	Circulate to Dean, Department Heads, and faculty for feedback
September 22:	Present to School Council meeting
October 1:	Make decisions on SA+P climate actions going forward.
October 15:	Expected MIT announcement on carbon neutrality for Scope 1 and 2.

Can SA+P unite its DLCs to adopt a bold strategy that distinguishes us within MIT, and recognizes our leadership position in relation to other schools of architecture and planning? The Action Plan proposed here draws on data that reveal SA+P's carbon footprint may seem small within MIT, but is significantly larger than per capita averages for Massachusetts or Germany (to take only two examples from Table 2.2). Climate action will require, as with so many of the challenges we face, hard examination of aspects of our culture that seem required for the work we do (studio travel, for example) but need to be recalibrated, paced, and structured to have far less impact than they now do in terms of greenhouse gas emissions. We hope this report has conveyed the information needed to shape the actions we must take, and the instigation to do so.

Appendices

The following appendices and data sources are available upon request; links will be provided when available:

- Case Studies, Building Energy Use
- Calculating Resilience for MIT
- Mobility Study, pre- and post-pandemic

Data were provided by MITOS (MIT Office for Sustainability); the authors are happy to connect readers of this report with the appropriate staff to review data analytics for any DLC.