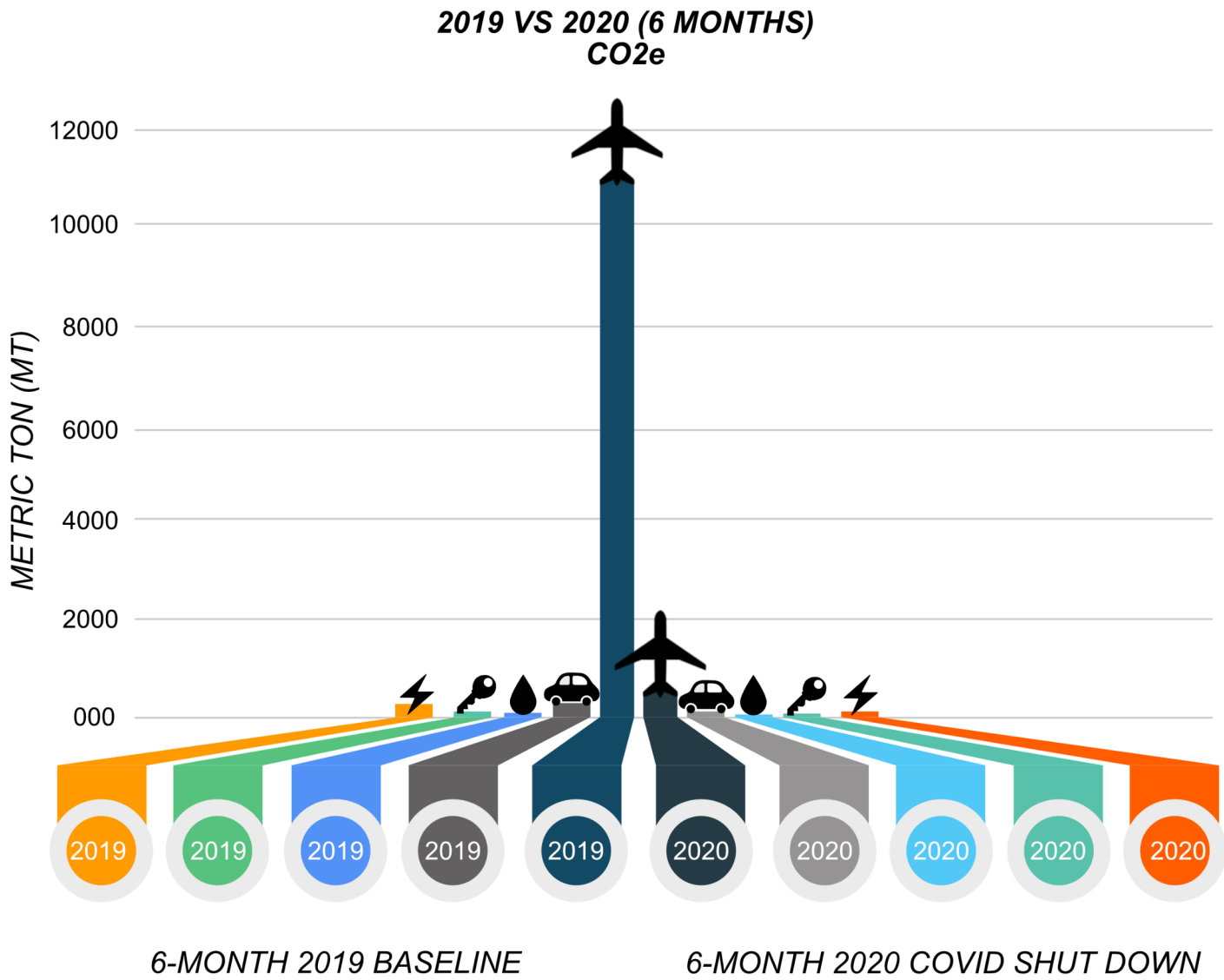


Analysis of Carbon Emissions Affected by COVID-19

Comparing LAS Emissions in 2019 and 2020

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INTRODUCTION

In late March of 2020 as rates of COVID-19 transmission continued to rise across the USA, design firm Lord Aeck Sargent (LAS) restricted public access to their corporate offices and requested all employees to work from home to the maximum extent possible. LAS had almost universal acceptance of this policy leaving offices in Georgia, Michigan, North Carolina, Kentucky, Texas, and Virginia effectively empty, along with many of the other businesses in these states and throughout the world. In addition to working from home, LAS also severely restricted business travel to only those trips deemed essential and granted pre-approval by management.

Annually since 2007, LAS has estimated the carbon emissions generated by office operations, specifically office energy use and business-related rental car and air travel, and offset the associated impacts with third-party verified Renewable Energy Credits and/or Carbon Offsets. However, as the reach of the COVID-19-induced shutdown has extended beyond what was initially anticipated, we sought to understand its impact on our office-operations-related carbon emissions. The goal of this analysis was to look beyond the typical 'business as usual' carbon accounting, using this disruption to better understand the key underlying factors driving operational emissions in order to provide data to prioritize improvements as we begin to transition to a post-COVID-19-era 'new normal.'

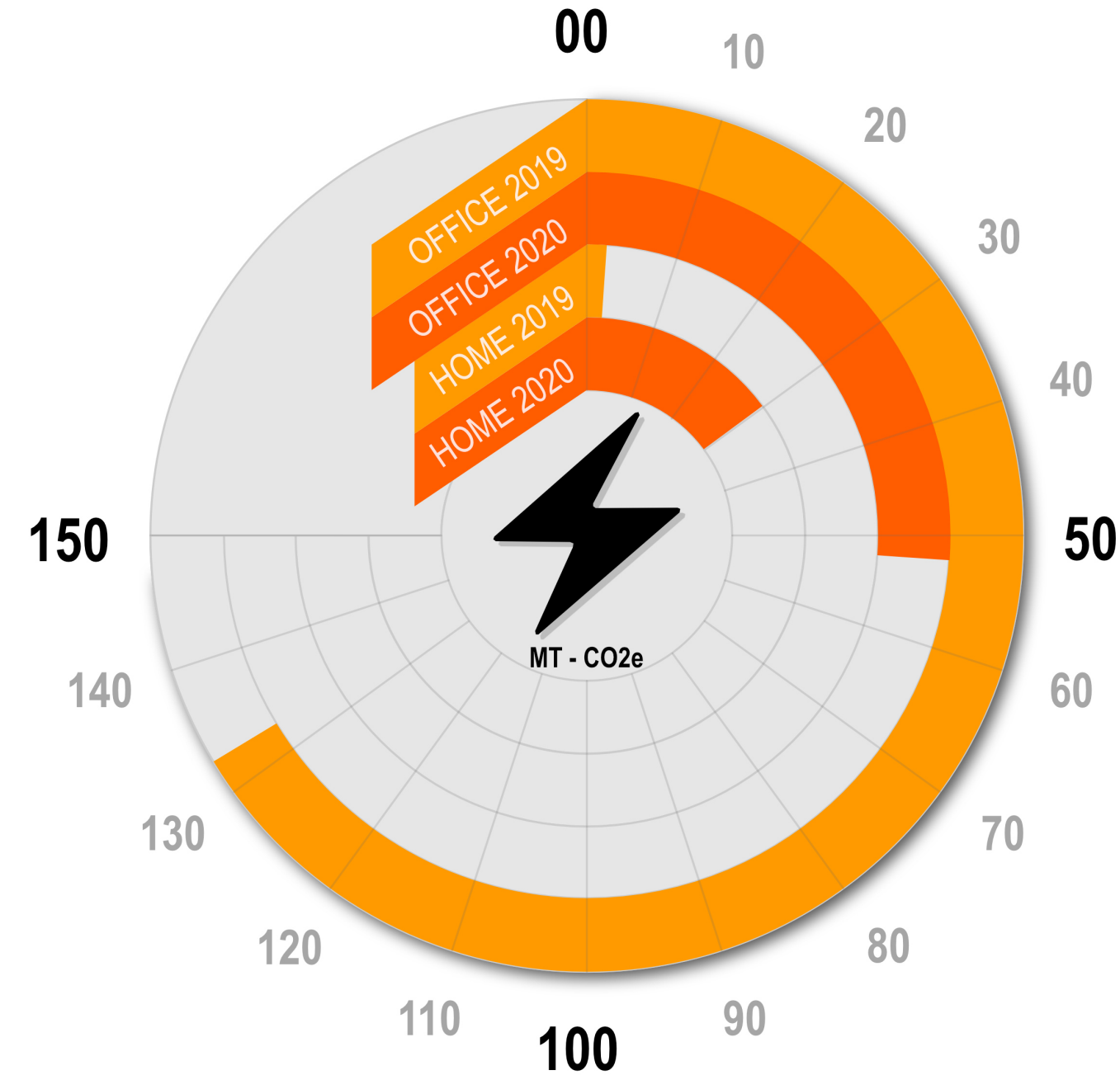
We began by looking at the immediately apparent factors of business travel, employee commuting, and office energy use and then expanded to include home office energy use and water usage to account for potentially hidden increased emissions. The impacts were estimated using available LAS operational data and publicly available data on usage of utilities, vehicles and air travel emissions, and other typical emissions factors.

The results are surprising. The calculated carbon emissions avoided during the first six months of the COVID-19 shutdown in 2020, compared to the same six-month period in 2019, totaled 10,513 metric tons of Carbon Dioxide equivalent emissions. That is the equivalent of more than 26 million miles driven in an average passenger vehicle. Reduced air travel resulted in carbon emissions reductions that eclipsed all other impact areas; however, the percentage impacts for other categories were still significant.

METHODS OF ANALYSIS

The categories analyzed for office operations-related carbon emissions include Energy Use (combined source), Water Use, Staff Commuting Mileage, and Rental Car Air Travel Mileage. Each category required its own methodology for determining quantities as outlined below. Each emissions category was analyzed for the first six months of the 2020 COVID-19 shut down, and a corresponding six months of 'normal operations' in 2019 for the baseline.

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ENERGY USE EMISSIONS

To determine the carbon emissions impacts of energy use, the total kilowatt hours (kWh) of energy use were converted to equivalent Carbon Dioxide emissions (CO2e) in metric tons using the Environmental Protection Agency’s (EPA) “eGRID” data for average US power generation emissions by municipal utility regions. Each office was analyzed separately for both periods. All six LAS offices are leased spaces in multi-tenant office buildings without submetered utilities. To estimate energy use for 2019 in the Atlanta office, the Energy Use Intensity (EUI) factor calculated during the process of obtaining LEED Platinum Certification for the office renovation was utilized. The LEED energy model identified a predicted EUI of 23 kBtu/sf/year applied to an office area of 26,000 square feet. For the other office locations, a baseline EUI was calculated using the EPA Target Finder median property site EUI for the zip code of each office.

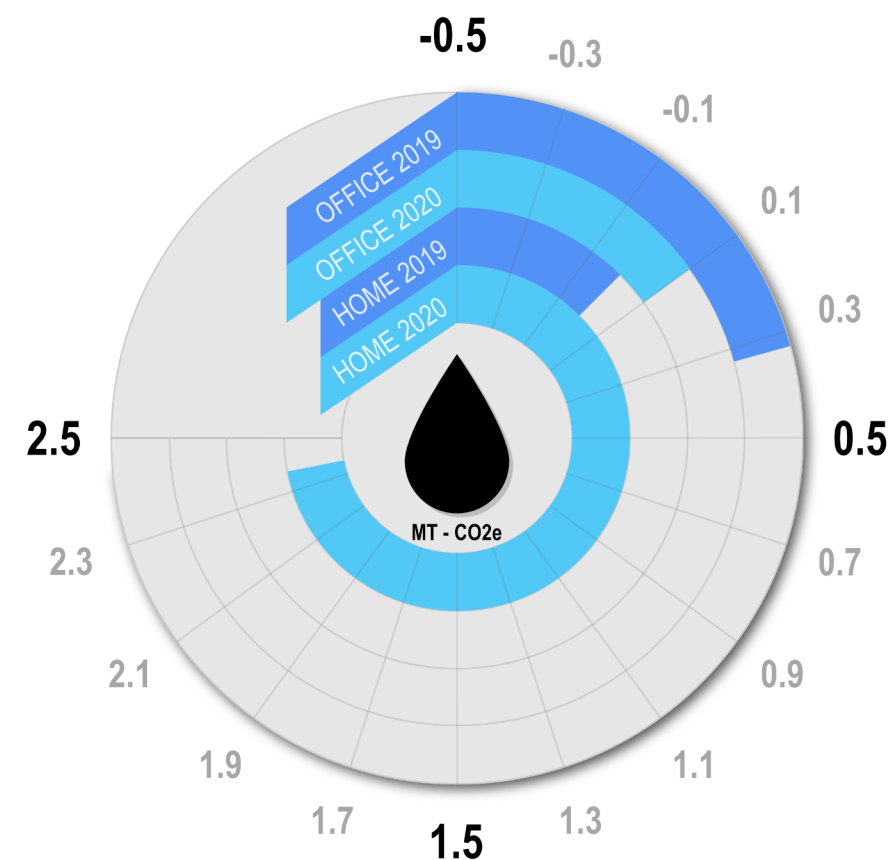
To approximate savings for the reduced occupancy in 2020, a savings factor was estimated. The U.S. Energy Information Administration (EIA) website has data on energy use in 2012 per end use such as lighting, heating and cooling, plug loads, water heating, and food preparation/storage and building type. By utilizing the EIA numbers for office buildings to identify percentage of energy used for the different end uses and applying an estimated reduction factor per end use type, the calculation resulted in an estimated overall energy use reduction of 38% due to the decreased office usage.

For instance, increased setbacks to the HVAC systems by the building operators are estimated to have reduced ventilation by approximately 25%; however, ventilation only represents 25% of the total energy use so the total energy use reduction was adjusted to reflect both factors. Limited control over the thermostat setbacks and lighting timing reduced some potential savings, as well as the continued use of office desktop computers, albeit via a remote connection.

Increased home energy use associated with the transition to working from home was also estimated. The EIA estimates that the average American household uses 10,972 kWh per year. This average usage was used to estimate the COVID-19 related increase for 2020, with the baseline for work-related home energy use in 2019 set at zero. The EIA also publishes data for total domestic energy use on a monthly basis and it shows a 7.26% increase in total energy use in the domestic energy use sector between April of 2019 and April of 2020. The increase between energy use in May of 2019 and 2020 is similarly 6.54% resulting in an average increase over those two months of 6.9%. For the 2020 data, this 6.9% increase to the average, per employee, was applied for six months of home office use. The average 6.9% increase represents an employee’s entire household increase in energy use. We did not attempt to reduce the total increase in emissions per each employee’s household size as that data is not available. Therefore, the increase in household energy usage is likely higher than actually would be used by an employee alone.

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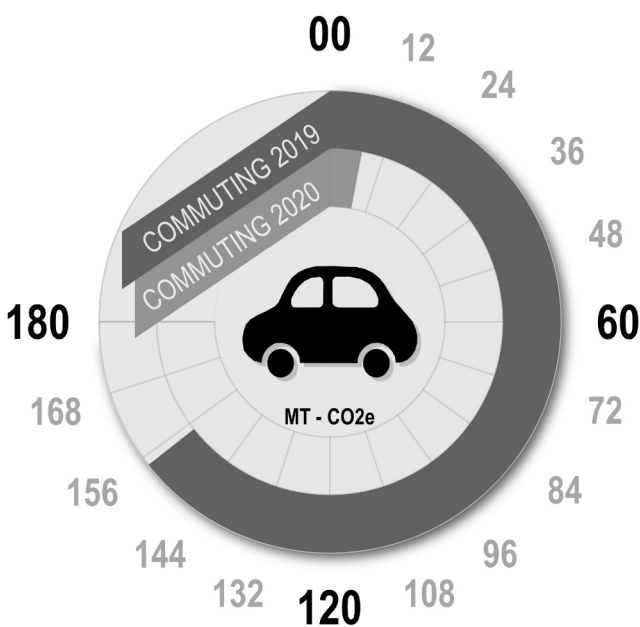
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WATER USE EMISSIONS

Baseline water use for the office in 2019 was estimated utilizing the data from the recent LEED Platinum Certification of the Atlanta office and using the same format with baseline fixture usage for all other locations' office populations combined. 2020 usage during the COVID-19 shut down was estimated by reducing the Full Time Equivalent (FTE) occupancy count from 113 in Atlanta and 56 in all other locations to an average daily occupancy of 5 in Atlanta and 1 in all other locations. Post-COVID office occupancy is tracked when any employee works in an office via a virtual health form allowing determination of the average number of in-person employees for 2020. The conversion factors estimated by the environmental

consultants to the EPA, Lean Six Sigma at leansixsigmaenvironment.org the carbon emissions equivalent for water use was determined. Using a similar methodology used to estimate home energy use, employee home use of water was assumed to have increased as a result of working from home. Per the EPA, a typical household member is expected to use an average of 100 gallons of water per day. Per Tech Republic, US home water use has increased by 21% since the beginning of the pandemic. This percentage increase was used to estimate increased household water use for each employee as a result of working from home.



COMMUTING EMISSIONS

The commuting mileage baseline for 2019 was calculated per employee by measuring the distance from each employee's home address to their local office. Information from the Atlanta Regional Commission on percentage of typical workers that drive alone, utilize train/rail, carpool, bus, walk/bike, taxi/Uber, vanpool, and telecommute was applied to the total number of miles traveled, regardless of where the employee calls home. Two-way travel was assumed for 240 work days per year.

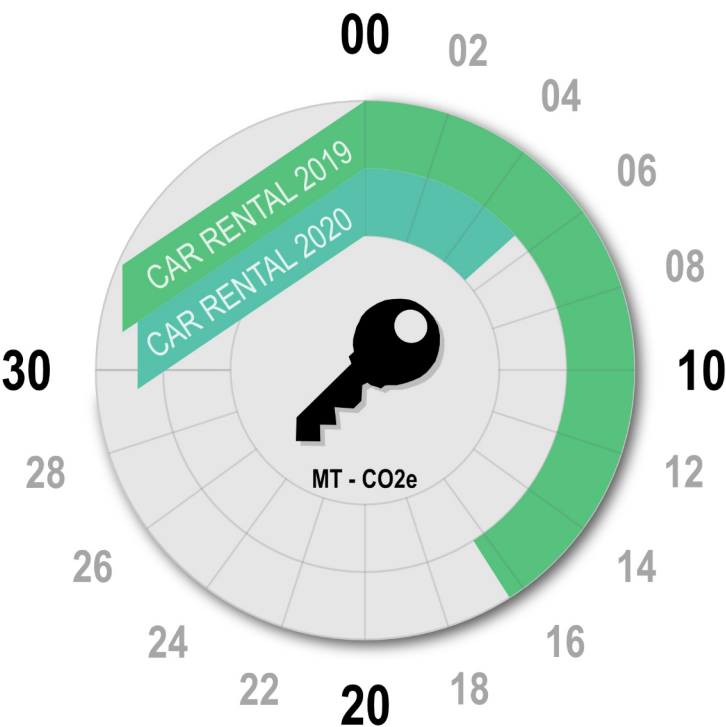
Data from the EPA on the average equivalent Miles per Gallon (MPG) for each mode of transport was applied to estimate total gallons of gas, and that was converted into CO2e in metric tons using data from the EPA. 2020 commuting was calculated assuming the average 6 employees now coming into all 6 of the offices combined drove by themselves and utilized the average miles traveled for our employees.

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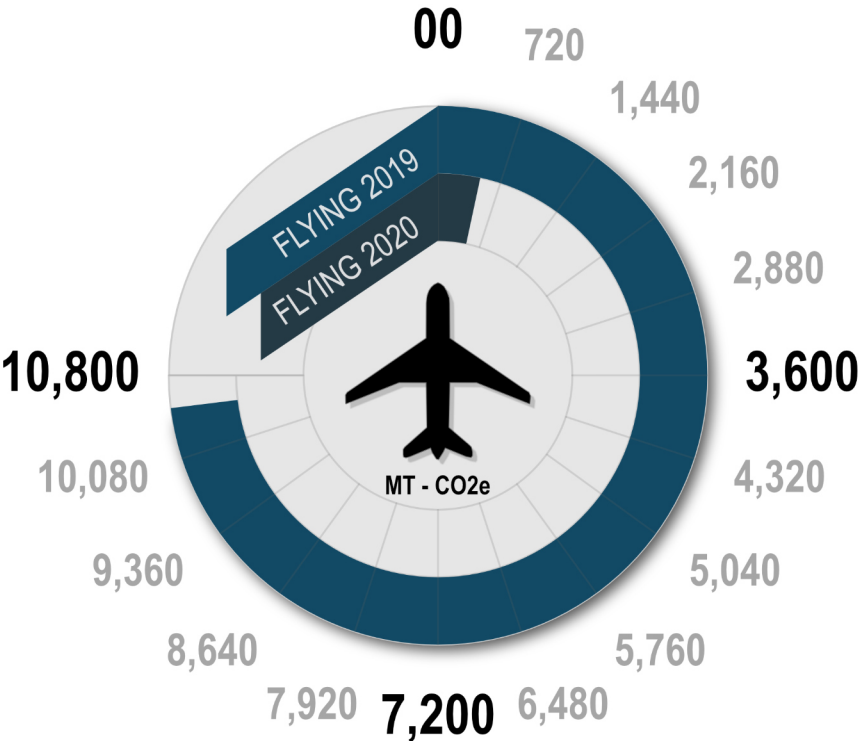
CAR RENTAL EMISSIONS

Car Rental Mileage for business travel is tracked by our office accounting systems and easily quantified. For each mile traveled in 2019 and in 2020 the weighted average MPG per the EPA's data on 2017 Domestic Consumption of Transportation Energy was used to determine the total gallons and associated CO2e emissions.

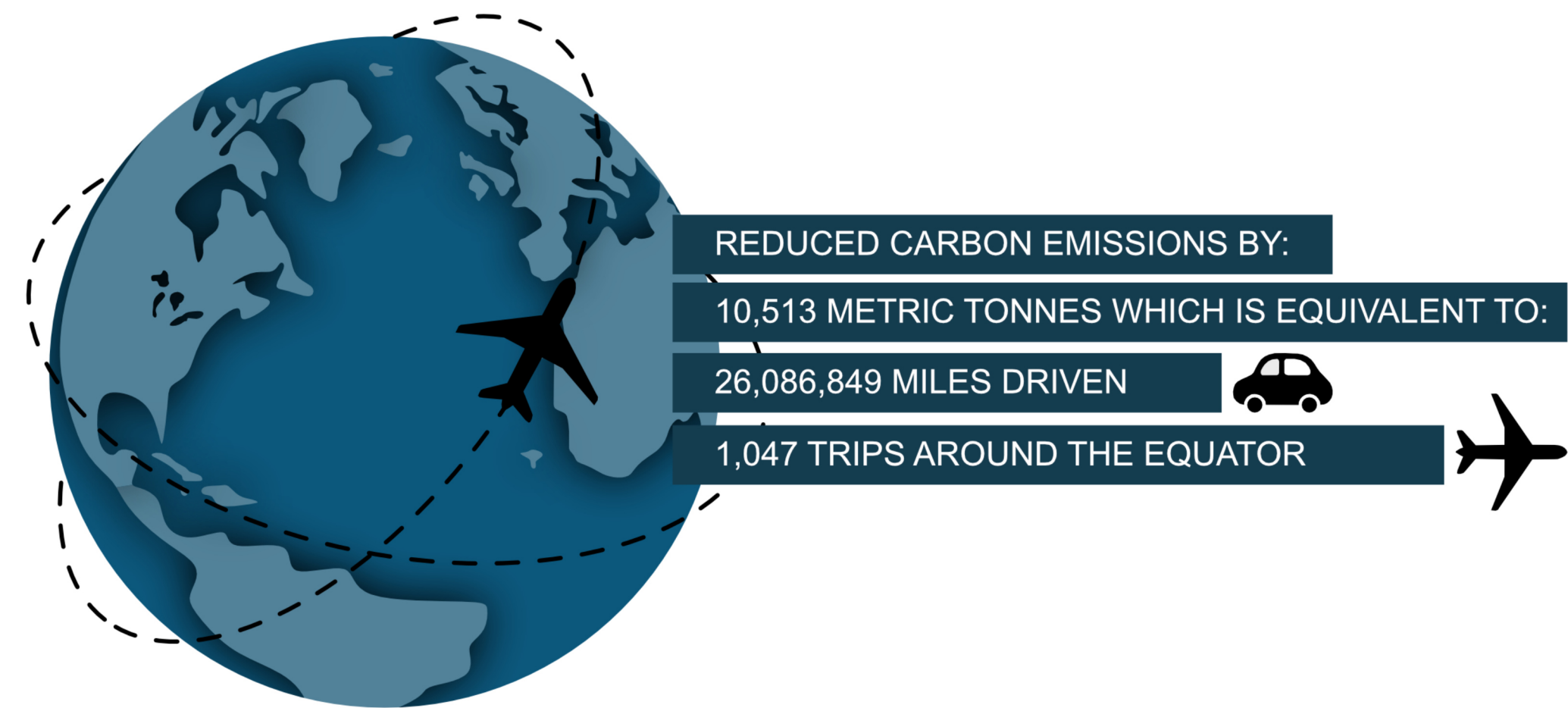


AIR TRAVEL EMISSIONS

Air mileage for business travel is tracked by office accounting systems as well. Per blueskymodel.org, an average passenger air mile generates 53.3 pounds of carbon emissions. This factor was used to calculate the metric tonnage of CO2e emissions per mile traveled, which was by far the largest operational carbon emissions impact calculated.



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CONCLUSIONS AND FOLLOW-UP

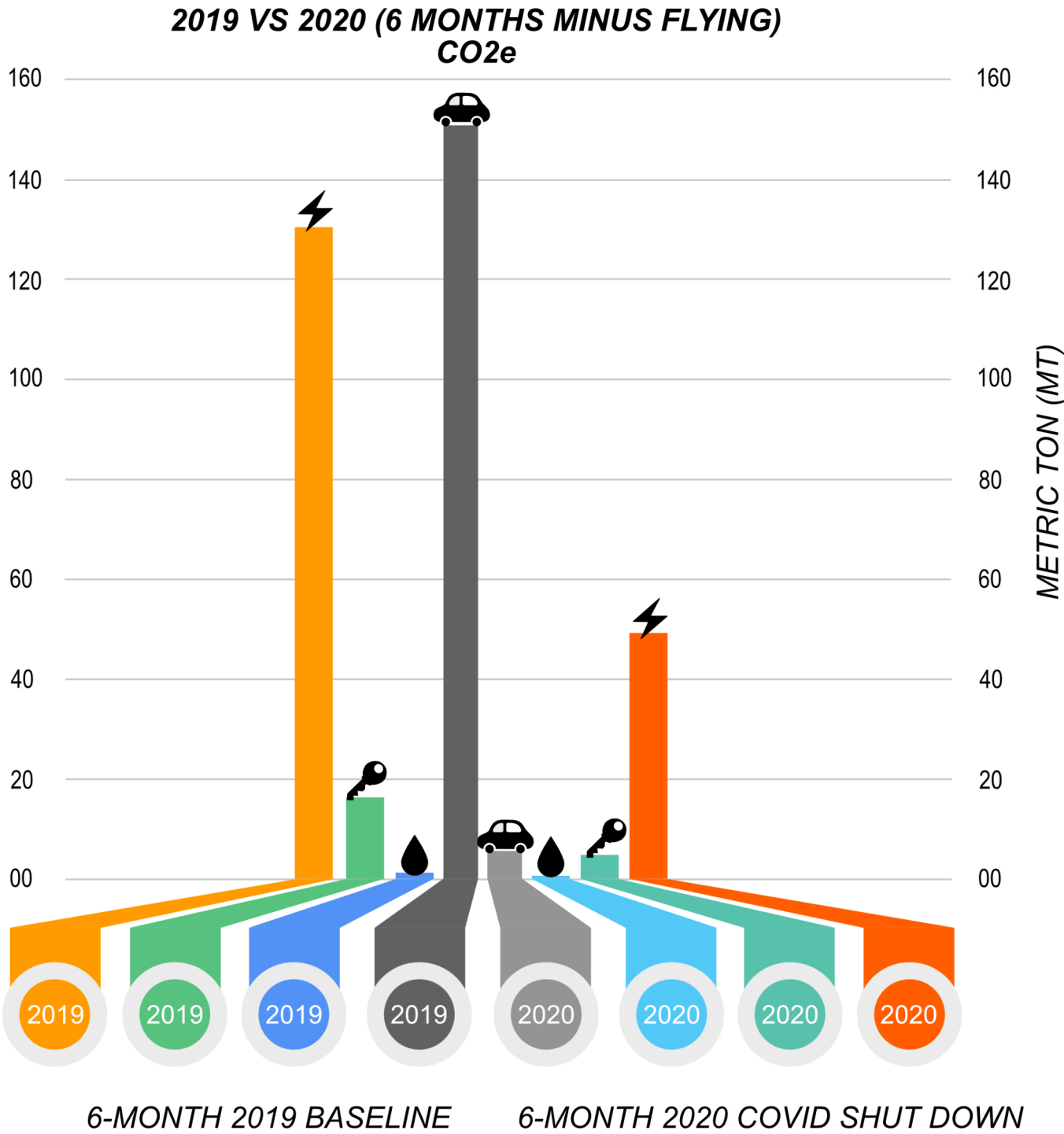
The impact of the first six months of the COVID-19 shut down is estimated to have reduced the office operations-related carbon emissions by 10,513 metric tons CO₂e. This is the equivalence of 26,086,849 miles driven by an average passenger car, enough to drive around the equator more than 1,000 times.

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THE IMPACT OF TRAVEL

The impact of air travel is particularly striking, representing 98 percent of the estimated operational carbon emissions reductions. Graphically, flying must be removed from the emissions chart to make the other categories legible. The next largest impact reduction was for Commuting, followed by Office Energy. For 2020, reduced commuting brought commuting emissions below both Home Energy and Office Energy emissions.



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PATH TO A NEW NORMAL

The significant, immediate emissions reductions associated with the workplace changes implemented in response to the COVID-19 pandemic raise important questions about the building design industry and the environmental impacts associated with operations. Based upon this preliminary analysis, some key operational factors should be considered as the building industry transitions to a new normal.

REDUCE FLYING

Halving flying from 2019 to 2020 essentially halved the LAS operational carbon emissions firm-wide. One strategy would be the implementation of a simplified evaluation policy for air travel approvals to enable informed decision making about whether a meeting must be done in person. Create a list of the important factors to your organization such as carbon impact, potential for income gained or lost, effectiveness of a virtual meeting for the topic, and the impact on quality of employee life. Then identify a simplified ranking system that allows tallying of points or other strategy for more transparently considering the significant associated climate change emissions associated with air travel.

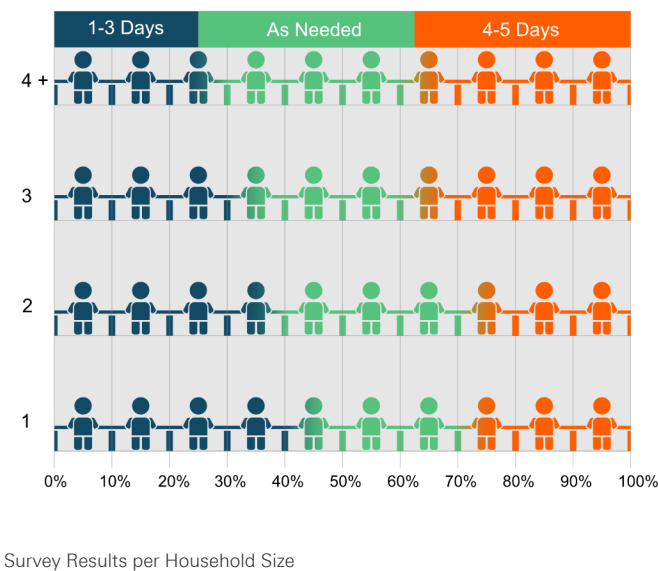
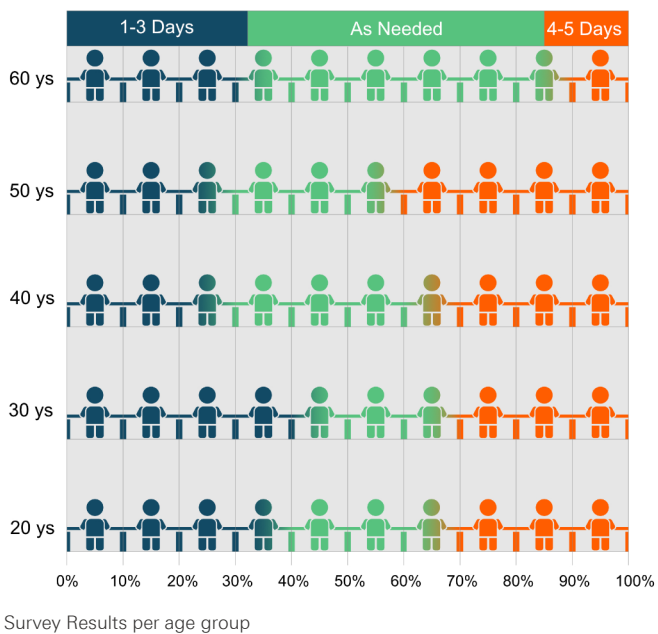
CONTINUE WORK FROM HOME

There are many anecdotes of workers appreciating the reduced commuting time that has resulted from this grand work from home experiment. LAS's Interiors practice area conducted a survey on the impact of work from home from an employee's perspective. With over 200 responses, the survey found that a large number of staff actually preferred working from home and indicated in-person attendance was not vital to most business activities. The identified ideal amount of time to work in the office varied with age and household size, but 'less than 5 days per week' was preferred across the board.

Assuming 2 days for the 1-3 group, 1 day for the As Needed group, and 4.5 days for the 4-5 day group yields only half of full attendance on a typical day. A half-full office would yield 73.66 metric tons of avoided carbon emissions in commuting alone. That's seven car trips around the equator. At an average annual cost of \$7,000/desk, that would suggest \$525,000/year in excess office rent that might be avoided.

And that may be a conservative estimate. An article in the Economist¹ evaluated data from Morgan Stanley for five European countries in varied states of reopening. For Germany the overall percentage was just 37.5% of workers working in the office on an average day compared to Pre-COVID. Whether this is a temporary step toward full occupancy or the beginning of a larger cultural change remains to be seen, but now that we have the systems in place continuing to utilize them makes sense.

1. <https://www.economist.com/briefing/2020/09/12/covid-19-has-forced-a-radical-shift-in-working-habits>



UNDERSTAND TOTAL CARBON IMPACTS

Design firms can influence more than their own direct operational impacts, which are likely to be eclipsed by the emissions of the buildings they design in the course of operations. For projects designed in 2019, LAS estimates that design decisions would ultimately translate to an estimated 217,757 tons CO₂e of avoided emissions through higher-performance design. Compared to the 22,103 tons CO₂e associated with COVID-19 operational changes, design decisions have an order of magnitude larger and longer term potential impact, and benefit, so it's important to also consider what we design as an industry, as well as how we operate.

ESTABLISH REDUCTION TARGETS

Increased working from home appears to yield productivity gains, improvements in employee happiness, potential real estate savings, and significant climate benefits, each organization should take an account of the benefits and identify targets for carbon reduction moving into the future. The building industry as a whole can take the lessons of COVID-19 and apply them to the future. Carbon reduction is not only about what is reduced, it also reaps tangible benefits. Reduced air travel and commuting time can result in increased productivity when implemented correctly for each situation. New policies and priorities can be effectively communicated to clients emphasizing the potential for project cost savings and client convenience. The instant connectivity available through technology can be used to build and maintain, and potentially improve, office culture in a hybrid model. We need to take the time as an industry now to have these discussions and find appropriate targets before we return to business as previously usual from force of habit.