MIT Scope 3 Greenhouse Gas Documentation:

Business Travel

Emissions Calculation Documentation

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Brian Goldberg, Jeremy Gregory, Yu Cheng, Grace DeMartino
POC | sustainableMIT@mit.edu

Motivation

The purpose of estimating MIT's business travel emissions is primarily to enable MIT to accelerate climate action planning by enabling users to understand the scale of MIT's travel-related scope 3 footprint and to identify opportunities for reduction. Estimating greenhouse gas (GHG) emissions of MIT business travel constitutes a fundamental aspect of MIT's Fast Forward initiative. Fast Forward: MIT's Climate Action Plan for the Decade, commits MIT to evaluate and expand its greenhouse gas portfolio accounting to include priority scope 3 emissions (e.g., purchased goods and services, sponsored MIT business travel, commuting). Calculating estimates of scope 3 GHG emissions enables MIT to evaluate activities and make comparisons across different scope 3 categories and with scope 1 and 2 emissions over time, thereby enabling data-driven decision-making around priority areas to target for GHG emissions reductions. Following GHG protocol, we looked at category 6, business travel, to evaluate MIT's scope 3 emissions related to business travel.

Scope

The scope of MIT's business travel GHG emissions includes transportation, accommodations, and meals for all MIT travel that is paid for by MIT funds. This includes, but is not limited to, travel for conferences, business meetings, athletic competitions, and study abroad programs. Any MIT travel not directly paid for by MIT funds is not included in this category. Excluded forms of travel include external scholarships provided to students for travel to/from home or study abroad locations, as well as any travel paid for by other sources such as family members, stipends, or entities inviting guest speakers or consultants.

Approach

There are two primary approaches for calculating GHG emissions. The first approach is process-based life cycle assessment (LCA), which uses data about transportation distances, vehicle types, and lodging locations. This detailed data is not consistently reported by MIT travelers during the request for reimbursement process. The second approach is environmentally extended input-output (EEIO) LCA, which uses data about the amount spent on travel activities. Process-based LCA is preferable for decisions about specific trips and transportation routes. EEIO LCA is an effective way to evaluate overall trends in emissions and compare them against other types of activities. Using spend-based or industry average emission factors can be a good step in getting rough order of magnitude emissions and materiality assessments.

Data on MIT-sponsored travel is most widely captured from the expense platform (Concur) used to process reimbursements for travel spending. The platform tracks spending across multiple categories, but it does not collect data on transportation routes, distances, and modes in a consistent way. As such, we use the EEIO LCA approach to estimate GHG emissions.
Our approach relies on one main equation, which allows us to calculate GHG emissions using spending:

$$GHG\ Emissions_{Activity} = Cost_{Activity} * GHG\ Emission\ Factor_{Activity}$$

Business travel activities are assigned into six categories relevant to GHG emissions and that can be inferred from the reimbursement platform: air travel, ground travel, water travel, accommodations, rail travel, and meals. The GHG emission factors associated with these activities are from the United States Environmentally-Extended Input-Output (USEEIO) modeling framework, developed by the US Environmental Protection Agency (EPA). The USEEIO activities are organized by North American Industry Classification System (NAICS) codes.

The USEEIO model is based on input-output data from the year 2012, so evaluating data from different years necessitates adjusting prices to account for inflation. To do this, we use the equation:

$$Expense_{reference\ year} = Expense_{fiscal\ year} * \frac{CPI_{reference\ year}}{CPI_{fiscal\ year}}$$

For our calculations, the reference year is held constant at 2012 and the fiscal year ranges from 2019 to 2023. 2012 was used as the reference year because it allowed us to match the USEEIO emission factors to the expenses since v2.0 of the USEEIO is based on the economy in 2012. With all of the expenses adjusted for inflation, based on the 2012 model, we were able to compare GHG emission factors across all years.

Data Sources

Data on MIT travel spending is extracted from reimbursement reports in the software platform Concur, provided by the Financial Operations team within MIT's Office of the Vice President for Finance. Every line item in a reimbursement report is assigned a travel expense category. Expenses for the six aforementioned categories are extracted for emissions calculations: air travel, ground travel, water travel, accommodations, rail travel, and meals. All other expenses are grouped into a category called "Other" that has no GHG emissions but is included in total spending summaries.

Table 1: Mapping MIT Travel Expense Categories to USEEIO v2.0 NAICS Codes and Emissions Factors

Business Travel Categories	NAICS Codes for USEEIO Emissions Factors	CO2 Emission Factors (provided by USEEIO) (in tons of CO2 per dollar)
Air Travel	481000	0.00102
Ground Travel (Car, Bus)	485000	0.000551
Water Travel (Ferry)	483000	0.000824
Rail Travel (Train)	482000	0.000754
Accommodations	721000	0.000326
Meals	722110	0.000442
Misc.		0

Visualizations

Calculated emissions and spending totals are presented in a dashboard created using Tableau. The dashboard includes business travel GHG emissions and spending for fiscal years starting with FY2019. To simplify interpretation of results, we grouped car, train, and ferry transportation under one category called ground transportation. GHG emissions and spending can be compared directly to demonstrate that they are not proportionally identical. That is, high spending in one type of activity does not necessarily correspond to high GHG emissions in that category.

Emissions and spending are also presented by MIT school area to enable these entities to use the data to support decarbonization discussions.

Here are the three dashboards available on [MIT Sustainability Datapool website](#):

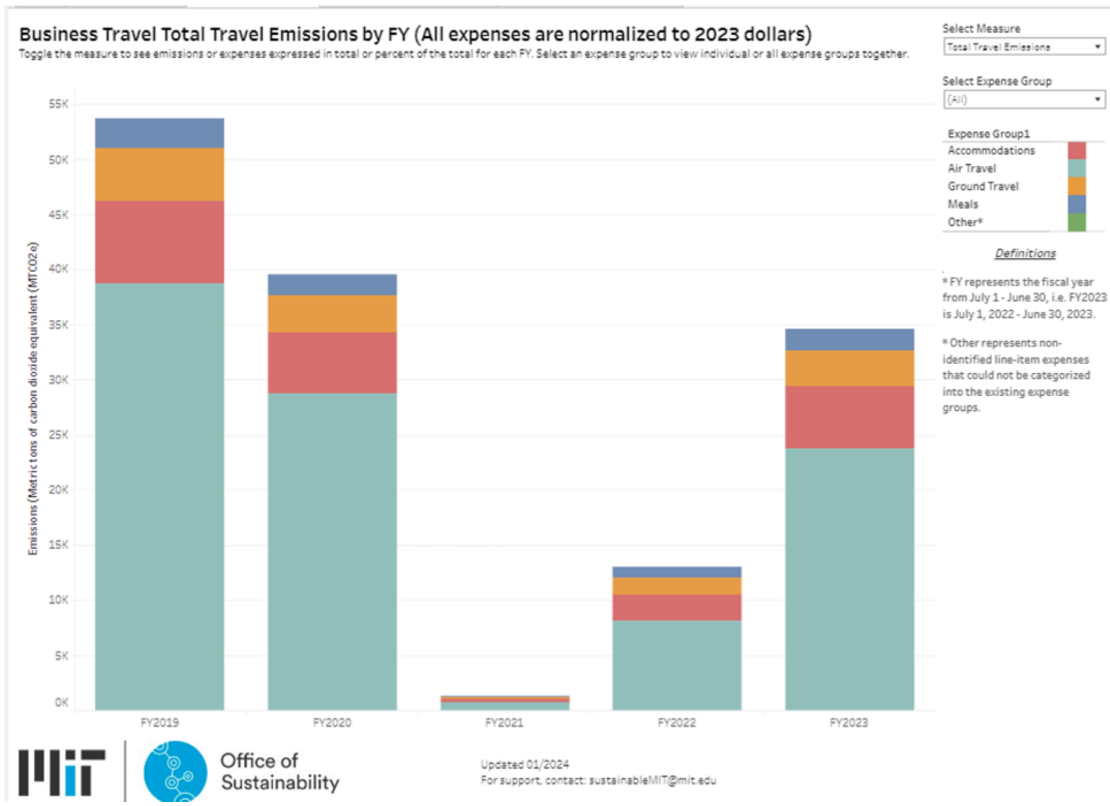

Figure 1: Business Travel Total Travel Emissions by FY (All expenses are normalized to 2023 dollars)

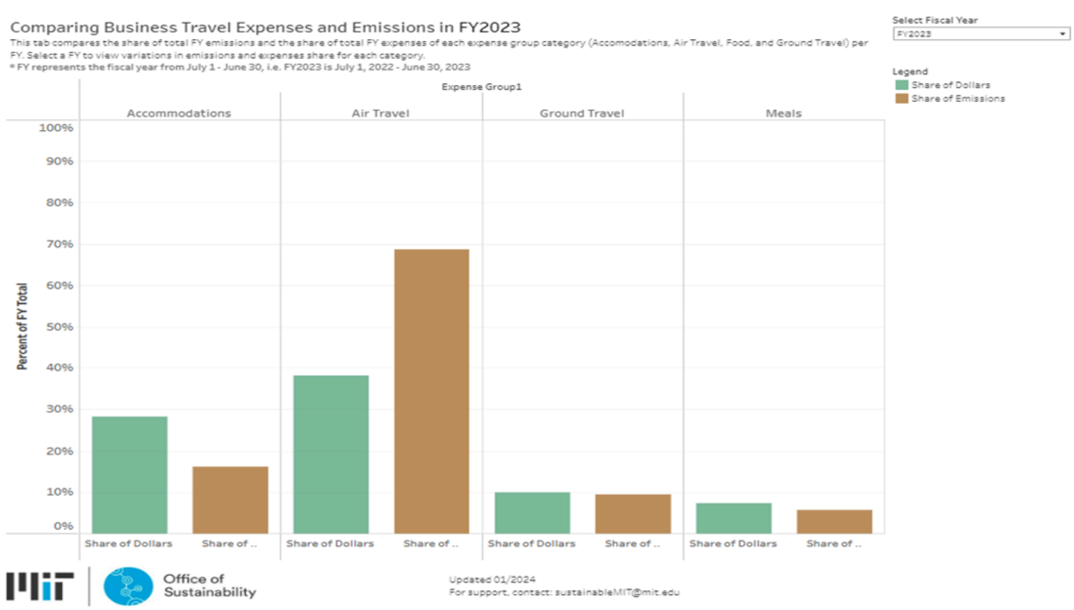

Figure 2: Comparing Business Travel Expenses and Emissions in FY2023

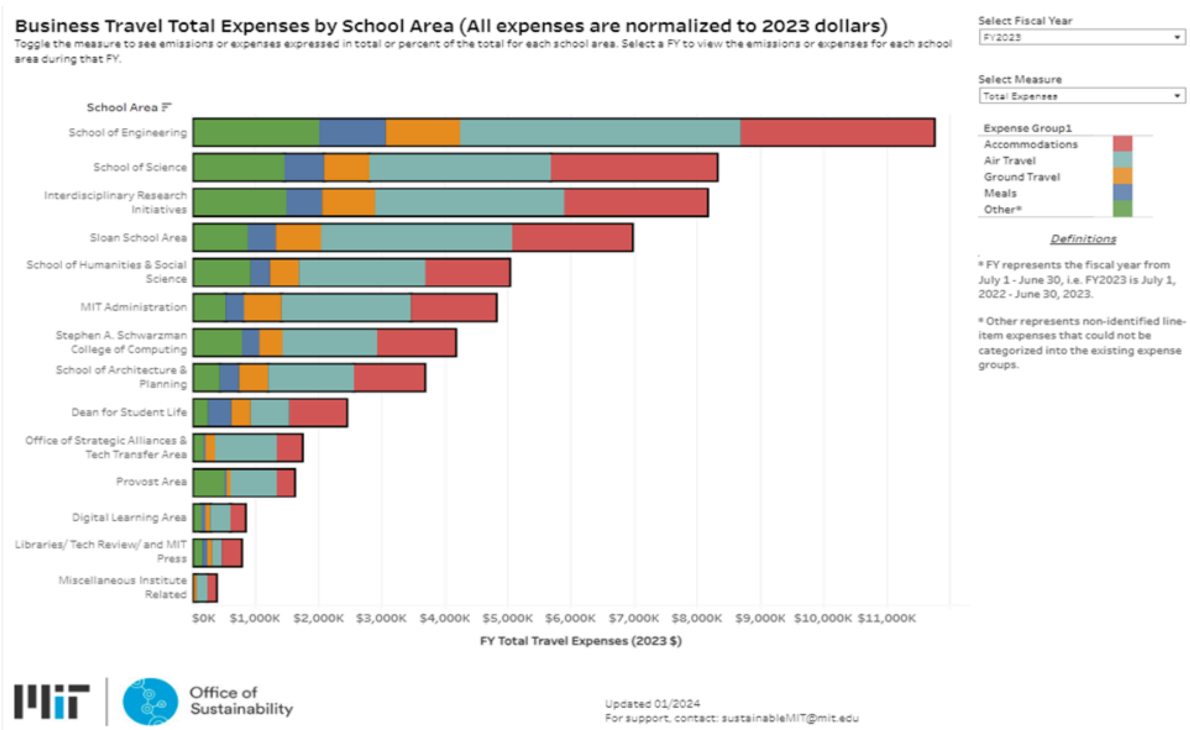

Figure 3: Business Travel Total Expenses by School Area (All expenses normalized to 2023 dollars)

Uncertainty

As the significance of scope 3 emissions becomes increasingly clear, access to data and improvements to reporting will likely follow suit. The estimation of GHG emissions from spend data using the EEIO LCA approach presents several sources of uncertainty. While the approach provides a comprehensive estimate of the interdependent contributions of various sectors of the economy to a particular sector of interest, it is an approximation of an entire sector. Hence, it does not enable analyses of specific products or processes. In addition, the EEIO LCA model assumes that all activities took place in the US and the spending followed US inflation trends, which is not applicable for all travel. We have not been able to calculate the exact amount of uncertainty due to these factors, but it is clear that the GHG estimates should be viewed as approximations that can be used to identify trends over time, make high-level comparisons of different activity categories, and identify priority activities for decarbonization. Once priority areas have been identified, more detailed analyses can be done using process-based LCA methods.