Addressing University of Toronto's Business-Related Scope 3 Air Travel Emissions

Released November 2020

CECCS committee and subcommittee members: Ahmed Azhari, Shamaila Bajwah, Aimy Bazylak, Lisa DeMarco, Steve Easterbrook, Aviatar Inbar, Paul Leitch, Shashi Kant, Bryan Karney, James MacLellan, Daniella Mallinick, Liat Margolis, Jan Mart-Smith, Fiona Miller, Jeffrey Miller, Jennifer Murphy, Derek Newton, David Roberts, Ron Saporta, Claire Westgate, John Robinson; Ayako Ariga and Dione Dias (lead)

CECCS Research Assistants: Rutu Patel (lead), Rashad Brugmann, Nicolas Côté, Meghan Henderson, Lauren McLachlan and Peter Vuong

Other contributors: Adriana Dossena and Jennifer Puskar *(Sustainability Office, St. George campus,* and Andrea Muehlebach *(Associate Professor, Department of Anthropology)*

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Executive Summary

In order to take action on climate change and keep the University of Toronto (U of T) on a path to becoming a net-positive institution, all while maintaining the accessibility of the campus and supporting business travel that cannot be mitigated, the President's Advisory Committee on the Environment, Climate Change, and Sustainability (CECCS) has proposed an institutional plan to capture the size and significance of air travel related scope 3 emissions across U of T. It consists of a three-pronged approach to address air travel at the University by quantifying, reducing and mitigating emissions, and is outlined in the report along with details on the progress and recommendations on all three fronts.

I. Quantifying air travel scope 3 emissions

To quantify the business-related air travel emissions generated by the U of T community, three sources of data were used: U of T's travel booking agency; reimbursements for air travel; and a survey on flying behaviour of a sample population. U of T's air travel emissions were estimated to be between twenty-six and fifty-eight thousand tonnes eCO_2 for 2018-2019, which represents between 23-51% of total scope 1 and 2 emissions in 2017-2018. The key recommendation is to collect air travel data in a centralized and standardized manner for future calculations. Based on the CECCS Research Assistants' findings from a literature review of issues related to institutional responsibility for scope 3 emissions, the report suggests that U of T adopt an ambitious approach that aims at accounting for the travel of U of T personnel and visitors whether it is paid by the University or not, which, given the current lack of initiative by other institutions to thoroughly count and address their air travel emission, would allow U of T to set a positive example and be an agent of change.

II. Reducing business-related air travel

Reducing the number of flights taken is the most efficient and effective way of mitigating scope 3 emissions. To mitigate the need for travel, the University should invest further in air travel policy and virtual conferencing infrastructure. A substantial change in academic culture, via updates to the Progress Through the Ranks (PTR) system, is also needed to incentivize the adoption of virtual conferencing. A typology of virtual conferencing approaches is presented, followed by a case study on U of T's lead role on *Distribute2020,* a biennial semi-virtual anthropology conference from which the CECCS will be conducting a life cycle analysis of greenhouse gas (GHG) emissions to quantify the GHG emissions. The CECCS has also established many connections across U of T departments to develop resources, training, and support for event organizers and attendees of virtual events.

III. Developing an emissions mitigation program at the U of T

For air travel that is unavoidable, a bespoke Air Travel Emissions Mitigation Initiative (ATEMI) that assesses a travel charge based on destination and class of flight has been developed by Operations and Real Estate Partnerships (OREP). The pilot applies only to designated executive travels for a period of six months, after which it will be evaluated for a decision to extend across the University. The proposed effort would collect funds from participating offices and contribute to new U of T emissions reduction projects that would otherwise not be possible in the near term. While the COVID-19 crisis means that this program has not yet been applied, it will be in effect when air travel resumes. Based on the ethical concerns about the use of Carbon Offsets identified through a literature review undertaken by the CECCS Research Assistants, recommendations are made for the ATEMI to aim to completely offset unavoidable air travel emissions wherever possible and to set quantified reduction targets.

Introduction

Climate change is one of the defining issues of our time. The University of Toronto (U of T), through its Low Carbon Action Plan released in September 2019, has committed to reducing greenhouse gas (GHG) emissions by 37% below 1990 level by the year 2030. A new target at the Downtown St. George Campus of net zero carbon by 2050 is going through approval. This commitment is a big step towards addressing GHG emissions but the plan alone does not address all the emissions of the University. According to the widely recognized GHG Protocol, institutional GHG emissions are accounted for in three categories: scope 1, scope 2, and scope 3. Scope 1 comprises direct emissions from owned assets; scope 2 comprises indirect emissions from purchased energy, and scope 3 includes all other indirect emissions from sources not owned or controlled by the institution, including emissions from academic and business-related air travel. However, scope 3 emissions are not covered under the United Nations Framework Convention on Climate Change (UNFCCC) and most other GHG reporting frameworks. As a result, formal reporting requirements and national and sub-national GHG emission reduction targets address only scope 1 and 2 emissions. Accordingly, the University of Toronto GHG emissions reduction commitment does not include scope 3 emissions. The President's Advisory Committee on Environment, Climate Change and Sustainability (CECCS) was approached by various stakeholders from the U of T community regarding U of T's plan to address business air travel (the biggest component of scope 3 emissions) and, with the support of the central and divisional administration at U of T, most notably from President Gertler, the Office of the President, the Office of the Chief Financial Officer, the Centre for Research & Innovation Support, the Centre for Teaching Support & Innovation, Facilities and Services, and the Department of Anthropology, saw the opportunity to develop an approach to measuring and addressing such business air travel emissions. Tackling business air travel could be a first step to a more comprehensive look at all scope 3 emissions.

In order to take action on climate change and keep U of T on a path to becoming a net-positive institution, all while maintaining the long-term accessibility of the campus and supporting necessary business air travel that cannot be mitigated, the CECCS has proposed an institutional plan to capture the size and significance of air travel related Scope 3 emissions across U of T and address climate change by reducing and mitigating emissions. We have adopted a three-pronged approach to address air travel at the University focusing on:

I) Quantifying scope 3 air travel emissions

II) Reducing business-related air travel, and

III) Developing an emissions mitigation program at the U of T.

The rationale of each of the three components is as follows. Firstly, quantifying the air travel scope 3 emissions is a key infrastructural need to set the context for the scale of emissions that is being discussed. Without a reliable and efficient method to quantify these emissions, the climate impact of U of T's air travel and effectiveness of any future programming cannot be demonstrated. Secondly, the most obvious and immediate solution to mitigating emissions from flying is to reduce business-related air travel at the University. Several strategies can be employed to achieve this reduction. One important strategy is developing virtual conferencing infrastructure at U of T to reduce travel to conferences, lectures and meetings, and this was the focus of our work on this topic. Lastly, as U of T is a large public research institution, we accept that not all business-related air travel will be mitigated and we therefore need to develop methods to 'mitigate' the emissions from the remaining air travel. Addressing these three facets of air travel will help address air travel scope 3 emissions at the University. Additionally, the work and recommendations in this report are extremely relevant to the institutional behaviour changes required by the recent COVID-19 pandemic.

Proposed Approach

I) Quantifying Air Travel Scope 3 Emissions

Developing a sustainable methodology to quantify business-related air travel at U of T is the first step in addressing the resulting scope 3 emissions. Although scope 3 includes various other indirect sources, the focus for the CECCS is on air travel as it makes up the bulk of the scope 3 institutional emissions. A brief analysis of GHG reports of five Canadian institutions (including U of T) reveals air travel emissions, despite a lack of comprehensive accounting measures by the University, contribute 9% to 54% of an institution's reported emissions (Appendix 5). At UBC, for example, a detailed study found that business-related air travel emissions were found to be equivalent to 75% of UBC's annual operational emissions (Wynes and Donner, 2018). In this section, a preliminary effort has been made to quantify U of T's aviation emissions.

In fall 2019, a group of students in ENV461/1103 '*The U of T Campus as a Living Lab for Sustainability*' course undertook a project to quantify the emissions from air travel at the University (See Appendix 1). The living lab course, taught by Professor John Robinson, pairs campus 'clients' with students who research and address real world problems and challenges faced by the clients on campus. For this project, CECCS Project Manager, Dione Dias, acted as the client in the course.

Methodology and results

To quantify the business-related air travel emissions generated by the U of T community, the students used three sources of data:

1. Avenue Travel, U of T's travel booking agency (showing booking data),
2. General Ledger (showing reimbursements for air travel issued through U of T Finances), and
3. A survey on flying behaviour of a sample population.

Data was collected from September 2018 to September 2019. During this time $2.9 million was spent via Avenue Travel while a total of $20.9 million was reported in air travel reimbursements in the financial system's General Ledger. This demonstrates that only approximately 10% of the flights were booked through Avenue Travel. Since the Avenue Travel data shows distances flown, while the General Ledger data does not, a combination of sources must be used to appropriately calculate U of T's air travel emissions. Top-down and bottom-up methods were used to generate a range of emissions.

For the **top-down approach**, Avenue Travel booking data was used to calculate the kilometers travelled per dollar for short-, medium- and long-haul flights. Proportions of the three flight categories were then applied to the General Ledger spending data to estimate total kilometres travelled.

Since emission intensity differs by flight distance, the total distance in each flight category was then used to calculate respective GHG emissions. This approach assumes the proportions of flight categories reported in Avenue Travel are true for the full General Ledger data.

For the **bottom-up approach**, a short survey was administered through the CECCS network which collected 79 responses totalling 115 round-trip flights. Using the origin-destinations reported in the survey, kilometers travelled by short-, medium-, and long-haul flights were classified. The average cost of each flight length from Avenue Travel was applied to estimate total spending and percent of spending by flight category. These percentages were applied to the General Ledger data to estimate the GHG emissions by respective flight categories. This approach assumes proportions reported in the survey are true for the full General Ledger data.

The two values produced by the two approaches span a range from 26 to 58 thousand tonnes eCO_2, respectively, as shown in **Table 1.** When compared to the GHG emissions of the University, these values are significant as they are equivalent to 23% to 51% of the total 114,265 tonnes eCO_2 emitted from Scope 1 and 2 sources (2017-18).

Method	Estimated Emissions (t eCO_2)	Air Travel Emissions as Proportion of Scope 1 & 2 Emissions
Top-Down Approach	26, 028	23%
Bottom-Up Approach	57, 838	51%

Table 1: *Range of Estimated Air Travel Emissions at U of T for September 2018 to September 2019. Total Scope 1 & 2 emissions in 2017-18 were 114,265 t eCO2.*

Limitations and conclusions

There are several limitations to this approach of estimating air travel emissions. The biggest challenge of this work was the lack of representative data. Bookings made through Avenue Travel accounted for only 10% of U of T's total spending on air travel while the survey results (meant originally to generate more representative data) captured only 0.65% of U of T's total air travel spending. Assuming the proportions of short-, medium- and long-haul flights from these data sources to be valid over the full General Ledger spending data is the only available methodology, however, the reliability of the emissions estimates is thereby diminished. Secondly, the flight classes are not specified in any case while emissions differ significantly between economy class travel, business class travel, and first-class travel. Ultimately, the students identified lack of a comprehensive dataset as the greatest challenge and made recommendations for U of T to establish a centralized and standardized method of collecting air travel data for all individuals travelling. A comprehensive dataset should collect the following information: relation of individuals to the University (staff, student, faculty, and visitor), origin and destination, flight class, cost of flight, who paid for the travel, and purpose of travel (meeting, conference, lecture, etc). The office of the Chief Financial Officer was consulted on the methodology of this study and agreed with the steps taken to reach these numbers. This support and approval was key to validating the results of this study.

Assigning Institutional Responsibility for Business Air Travel at the University of Toronto

To address scope 3 air travel emissions, what is counted as U of T travel needs to be established in order to determine which air travel emissions are the responsibility of U of T. Following the discussion on institutional responsibility of the University in 'inducing' air travel at the December 2019 CECCS meeting, a literature review was undertaken by CECCS Research Assistants to compare the implications of the two proposed approaches to assigning responsibility:

1) Accepting responsibility for the air travel the University pays for (University Paid approach). This would include all business travel university faculty staff and students, and invited guests whose travel costs are paid by the university.
2) Accepting responsibility for all travel undertaken by students, staff and faculty of the University, whether paid for by the university or not ("University People" approach).

These two options are represented in Figure 1. In light n this topic, we sought an answer to the question of *how* to assign responsibility by broadening our research scope and looking also at petitions, pledges, open letters and institutional publications. A total of 20 sources, 11 of which were University publications on air travel mitigation strategies, were reviewed to develop our conclusions. The objective of this review was to understand how the approaches compare in their implications, what peer institutions are doing, and how we can improve upon those efforts.

Categories of air travel emissions at the University

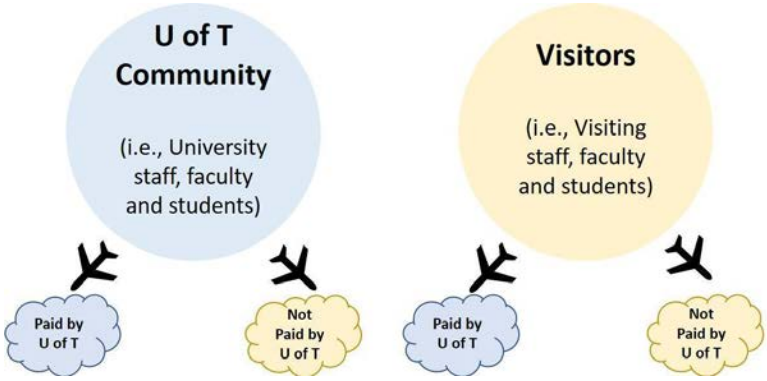


Figure 1: *Sources of air travel emissions at U of T.*

As seen in **Figure 1**, the air travel emissions were categorized as attributable to both the U of T community and visitors. The U of T community includes students, staff and faculty of the university, while the visiting community includes visitors to campus such as external staff, contractors/consultants, faculty from other universities, visiting speakers, conference participants, and more. The travel of both of these communities may or may not be paid for by U of T. The discrepancy in assigning responsibility arises in many cases because the U of T community's travel may be funded by other institutions (e.g. a faculty member invited to deliver a keynote address at another institution). However, that behaviour may be incentivized via indirect pathways. For example, academics are rewarded with career advancements at the University for traditional academic behaviour, like travelling frequently for conferences, keynotes and guest lectures. The opposite also occurs, where U of T invites visitors to our campuses by funding their travel. In these cases, it is difficult to determine whether U of T 'induced' the air travel emissions. A further literature review was conducted to identify how others have defined the boundaries of responsibility. See **Figure 2** below for a visual representation of the University Paid versus the University People approaches, as they apply to the categories of air travel emissions at the University.

Discussion

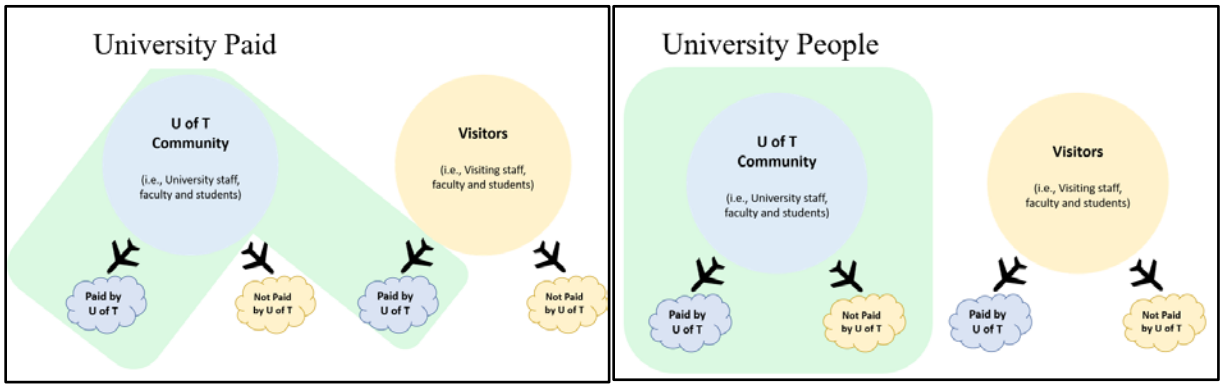


Figure 2: *University Paid (left): Assigning responsibility by air travel U of T pays for. University People (right): Assigning responsibility by travel undertaken by U of T Community. Green highlights indicated the emissions included in emissions accounting.*

University Paid approach was found to be relatively popular among implemented projects and strategies included in the literature review. While it is not the case at U of T, some institutions centrally process travel booking and/or financial data which makes goal setting and monitoring easier.

Additionally, adopting this approach makes the business case of financial savings upon mitigating travel, which may be convincing for many campus stakeholders. All the initiatives using the University Paid approach relied on financial data to estimate air travel emissions of the institution, implying that the University is only responsible for emissions generated from travel funded by the institution (see Appendix 2).

The University People approach, on the other hand, was treated inconsistently in the literature. Some initiatives were classified as this approach because they used self-report methods in addition to financial data to estimate emissions (Appendix 2) which opens up the possibility of accounting staff and faculty air travel which may not have been paid for by the University. The boundaries of the not-paid air travel were not specified for each case.

An important difference which emerges from comparing the University Paid and University People approaches is that the latter enables carbon accounting of student air travel (Appendix 2). Davies and Dunk (2016) argue that since "(Higher Education Institutions) HEIs are explicitly providing education for overseas students and study-abroad opportunities", Universities are responsible for the resultant air travel. A Université de Montréal study of air travel emissions included extensive calculations of study-abroad student air travel and the annual home visits by international students which amounted to 30% of the University's overall emissions (Arsenault et al., 2019). Davies and Dunk (2016) go as far as to argue that not only the travel by international students visiting home, but the travel of their visiting friends and relatives may also be attributable to the institution. Davies and Dunk's argument is a critique of the internationalization agendas of 21st century universities (2016). Manchester Metropolitan University has therefore established a Carbon Literacy Project to remedy this misalignment between the internationalization strategy of education and their climate targets (Dunk et al, 2017). This aspect of student air travel as institutional responsibility completely disappears when considering the University Paid approach, since in most cases the University doesn't pay for this travel.

Another important concern arising from this pursuit of defining boundaries of responsibility is the 'double counting' of air travel emissions. 'Double counting' particularly applies to visitor travel since emissions of their visit may be included in the emissions accounting of both institutions. Most of the initiatives classified as University People approach in the spreadsheet do not explicitly address or include the travel of visitors as part of their approach. Only Grant et al. (2019) partly addressed visitor air travel to campus as a source of emissions which was 23% of their air travel emissions. In this case, they used the University Paid approach (financial records) to identify the proportion. Many of the initiatives supporting the University People approach, however, supported the inclusion of all air travel by University personnel, even which is not paid by the University, in the emissions calculation (see Appendix 2).

Recommendations and way forward for U of T on Assigning Responsibility for Air Travel

The main difference between the University Paid and University People approaches is the emission sources they account for. While the University Paid approach is effective at capturing travel of staff and some visitors to campus, it largely misses the faculty travel that is not paid by the University as well as student air travel (home visits by international students and study abroad opportunities). Even the visitor air travel is only partially captured since there are many instances of visitors on campus that may have their travel paid for by another institution or organization. The University People approach then opens up the possibility of accounting for the previously missed faculty and student travel through surveys and self-reporting methods. Here, however, the visitors' air travel is completely ignored since 'visitors' are not University personnel. Absolving institutions of responsibility for inducing visitor air travel (e.g. in the form of inviting international speakers and attendees rather than virtual conferencing) is not facilitative of a transition to low-carbon University culture.

Therefore, the CECCS suggests that U of T should adopt an ambitious approach that aims at accounting all four sources of air travel emissions (as a combination of the University Paid and University People approaches). **Figure 3** describes the data collection opportunities at U of T for comprehensive emissions accounting along with potential data gaps. Altogether, the data collected from all four sources will be subject to the 3-pronged approach of addressing scope 3 air travel emissions at U of T.

We believe this combined approach is particularly important given the current lack of initiative by other institutions to thoroughly count and address their air travel emissions. Double-counting of emissions, then, is a future concern, since most institutions still don't count their own share. When accounting and reporting on scope 3 air travel emissions becomes as common a practice as scope 1 and 2, a more selective method can be applied. Until then however, it makes sense for U of T to set a positive example and be an agent of change.

While the approach proposed here is ambitious, despite comprehensive methods of accounting it is very possible that we would miss many sources of emissions; especially visitor travel which is not paid for by the University. At the core of this comprehensive approach, however, is the intent to adhere to the science of climate change and an acknowledgment of the urgent need for significant emission reductions.

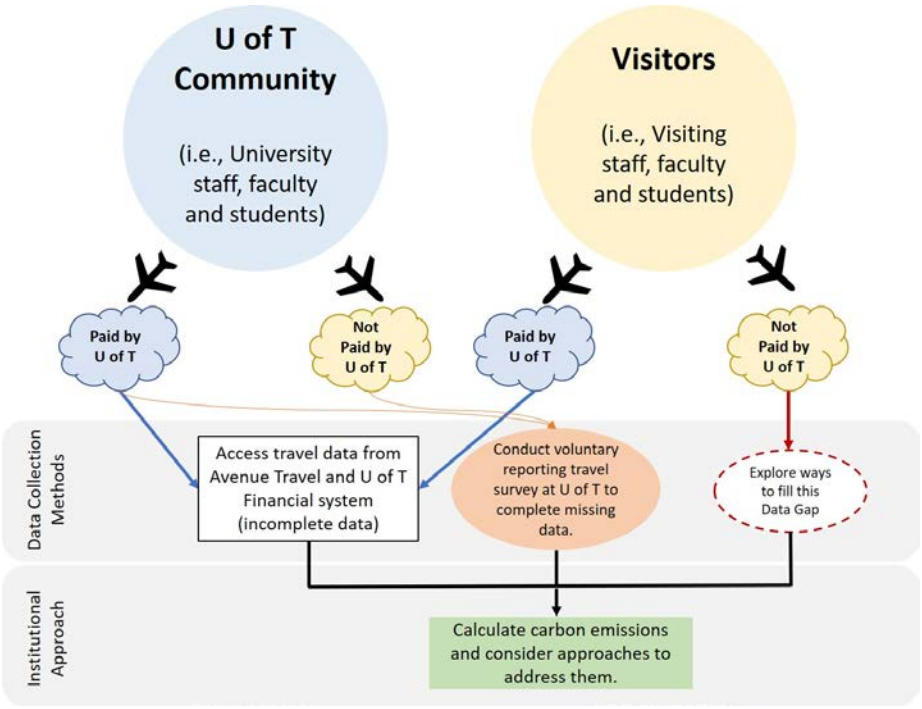


Figure 3: *Methods and strategies to address the four sources of air travel emissions at U of T.*

II) Reducing Business-Related Air Travel at U of T

Reducing the number of flights taken is the most effective way of mitigating scope 3 emissions. Additionally, under the COVID-19 pandemic, limits to travel will continue to pose challenges to the functions of the University. The following work and recommendations are our effort to initiate a sustainable transformation in the U of T's business travel behaviour. Influencing behaviour is challenging and requires strong administration, ongoing coordination and communication. There are two parts to this strategy; to reduce travel via policies, and via virtual conferencing alternatives.

First is to consider applying travel mitigative strategies to limit or discourage unnecessary air travel and to reduce travel GHG emissions. Examples include (Wynes and Donnor, 2018; Burian, 2018):

- the elimination of same-day return flights,
- reducing flying for one-night stays,
- reducing group travel,
- favoring direct flights over lay overs,
- requiring University personnel to travel by Economy Class only, and
- altering reimbursement rules requiring travel via the cheapest option only.

Each of the strategies above can limit air travel and create measurable emission reductions among other benefits. Eliminating same-day return flights and one-night stays, for example, can result in financial savings as well as time savings for the travelling individual. In these cases, the individual spends more time and energy in travelling than in the face-to-face meeting. Reducing group travel helps avoid redundant emissions, unless the presence of more than one person has significant work benefits. Direct flights should be favored over indirect routes since indirect flights waste more fuel for multiple take-offs and landings, generating more emissions (Lewis, 2013). Travel by Economy class is also favorable because the emissions per person are lower. Lastly, eliminating the requirement of using the cheapest travel option can promote land-based travel or purchase of direct flights, since train travel and direct flights, despite their emission benefits, are often more expensive. The last point was emphasized by both Burian (2018) and Wynes and Donnor (2018). The “cheapest travel option” requirement at their respective institutions was potentially barring traveller’s access to more sustainable travel.

Specific practices within the reimbursement system can create barriers to sustainable travel at U of T. At present, the policy prioritizes financial efficiency to assess eligibility for reimbursement. For example, U of T’s Policies and Guidelines for Travel and other Reimbursable Expenses includes a requirement stating: “Travellers should request the lowest available fare at the time of booking” which likely discourages the use of land-based travel and direct flights. Another example includes the difficulty of combining several visits into one roundtrip to mitigate travel emissions. For example, a faculty member combining their visit to Hong Kong for a conference and to Taiwan for field work may experience difficulty being reimbursed for the four days between these two purposes of travel. In this way the reimbursement policy forces the traveller to either emit more with repeated travel or to personally absorb financial costs. In such cases, the current reimbursement policy fails to reward decisions based on sustainability. To mitigate scope 3 air travel emissions, travelling staff and faculty will need appropriate administrative support. Therefore, it is recommended that a policy based on emissions reduction, in addition to financial savings, be considered at the University.

A second strategy is to invest in developing Information and Communication Technology (ICT) infrastructure to increase capacity for virtual conferencing as an alternative to in-person attendance. The success of many of the above travel mitigative strategies is dependent on the availability and accessibility of appropriate ICT infrastructure. If virtual conferencing were accessible, and easy-to-use, much of the Staff and Faculty’s same-day and one-night stay travels could be effectively eliminated. For this reason, a deep focus on developing virtual conferencing infrastructure at U of T is key to mitigating air travel scope 3 emissions. Additionally, investing in ICT infrastructure will improve the capacity and efficiency of tri-campus collaborations at U of T. The recent COVID-19 crisis has added substantial emphasis to the push towards more virtual interaction. It would be useful to keep a watching brief on the very many new approaches to virtual meetings and conferences that are now being adopted around the world.

Several strategic steps must be taken to improve access, reliability and adoption of virtual communication in a University setting. ICT development requires a central, mandated push as part of climate action planning (Wynes and Donner, 2018). One key behavioural motivator is offering equal “credit” for virtually delivered presentations, lectures and talks for career advancement of younger

academics at U of T. Adjustments to U of T's Progress Through the Ranks (PTR) system, a merit-based promotion system for faculty and librarians, are probably required, along with a broader shift in the academic culture. Moving forward, U of T should consider ways of establishing collaborations with other organizations and institutions to mitigate air travel emissions as a way to push for a change in the broader academic culture. This shift in the academic culture can then provide the incentive for academics to use these virtual conferencing options when available.

In the meantime, virtual conferencing can be supported by regularly updating institutional software licenses, developing state of the art virtual conferencing facilities and providing funds as incentives for departments or units that opt for virtual meetings (Wynes and Donner, 2018). At U of T, these ambitions are supported and welcomed by many actors within the institution. Since October 2019, the CECCS has met with several academics and conference organizers expressing interest in virtual communication over in-person attendance. This interest has ballooned with the onset of the COVID-19 crisis.

Virtual Conferencing Models: A Case Study at U of T

Developing ICT infrastructure requires considering the needs of various kinds of uses; conference presentations, meetings, lectures, workshops and more. Each of these uses require different technological affordances. There are 4 basic models of conferencing (See **Table 3**):

1. traditional in-person conference,
2. live-streaming model of conference,
3. teleconferencing model, and
4. the hybrid models which combine various methods in different capacities.

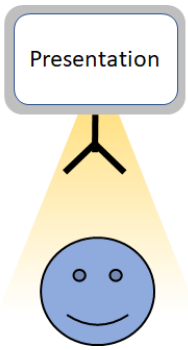
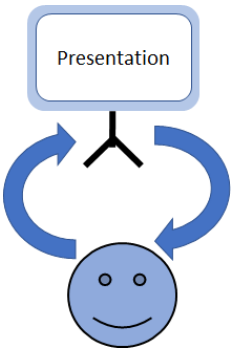
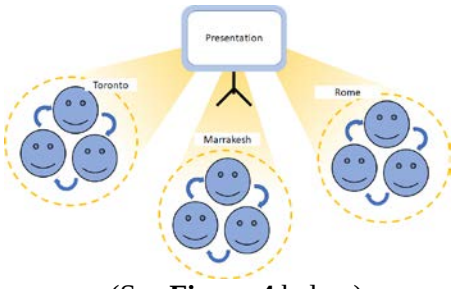
Traditional In-Person	**Live Stream**	**Teleconferencing (several interacting screens)**	**Hybrid Model (One example below)**
Traditional conference with all speakers and attendees meeting at one location for set programming.	Largely traditional conference with live-stream/broadcast for virtual attendees.	Semi-hybrid programming with several interacting screens of presenters and attendees. Enables bilateral communication.	A combination of various models fit the specific needs of the programming.
			 (See **Figure 4** below)

Table 3: *Virtual Conference models.*

These models were conceptualized based on a study of the literature on academic air travel, virtual conferencing and virtual event case-studies. A full list of the literature has been compiled as a resource for use at the University (see Appendix 3). The models were then applied to events of various sizes and objectives to create a 'Menu of Options for Virtual Conferencing' (see Appendix 4). This document was created for those looking to plan a virtual event and lays out the pros and cons of each virtual event model, along with hardware and software needs. Furthermore, to complement the 'Menu of Options', the CECCS is currently developing caselets of the different models of virtual events with best-practices from and for event organizers. The caselets will be available as a resource for staff and Faculty at U of T. These are working documents that are meant to be updated as new models and solutions become available.

Case study

U of T took the lead with *Distribute2020*; a biennial conference which took place May 7, 8, and 9th and which was co-organized by the Society for Cultural Anthropology (SCA) and the Society for Visual Anthropology (SVA), both sections of the American Anthropological Association). *Distribute2020* was a near-carbon-neutral (NCN) conference which originally intended to follow a virtual-hybrid model of conferencing (See **Figure 4**).

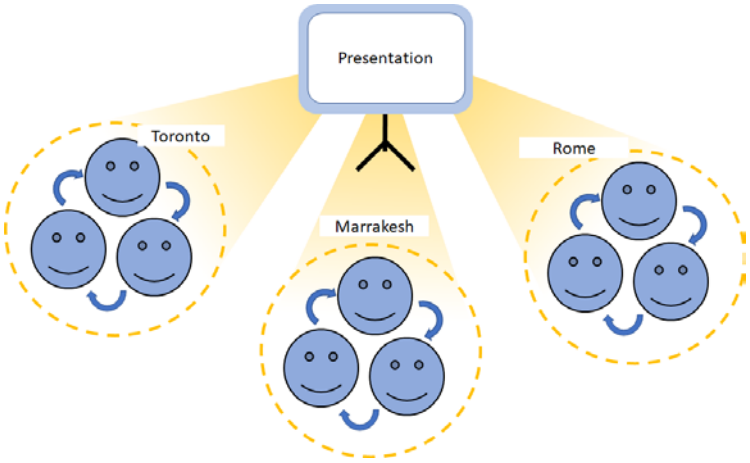


Figure 4: *Hybrid conference model of* Distribute2020.

Distribute2020 was hosted on a dedicated website, where pre-recorded multimedia presentations were streamed from May 7th to 9th 2020 in one continuous, 72-hour live stream. Each panel was streamed three times over the course of three 24-hour loops, which allowed for viewers from all over the world to view panels at times that matched their time zones. The originally planned hybrid model had groups watching the conference via in-person "viewing nodes" as had been the case in 2018, when the SCA and SVA first pioneered this conference model. Because the pandemic made in-person gatherings impossible, Distribute2020 designed a "Virtual Hallway," where participants could gather after the showing of panels for discussions with panelists in real-time. Discussions in this Virtual Hallway exceeded all expectations and were not only unexpectedly lively but exceptionally inclusive. Many hallway discussions included not just professors but also students from all over the world. This made the Virtual Hallway not only a space for conversation but unprecedented collective learning and networking.

This model bears many benefits once it can be taken up again in its fully distributed form, i.e. with local viewing nodes. First, the budgetary savings on venue and catering means the conference tickets can be made affordable, increasing accessibility by lowering financial barriers to participation. Distribute2020 is a case in point: It cost only $10 - for individuals and between $100-$200 for institutional nodes. A preliminary count reveals that Distribute2020 saw a total of 1,029 conference participants, with registrations still trickling in as Distribute2020's film festival continues until May 14. This far exceeds the 250 registered participants usually attending SCA's in-person conferences.

Second, the virtual hosting of media means people from all over the world, even from the global South where participation has been low in the past, can participate, making the conference more equitable. Distribute2020 saw record participation from over 65 countries and hundreds of cities, a scale and breadth that again vastly exceeded participation in SCA's past, in-person conference.

Lastly, NCN conference models need not exclude networking opportunities. The Virtual Hallways (as well as our "Coffee With …" sessions which allowed for emerging scholars to meet with established scholars as well as with the editors of several prominent presses including Duke University Press and Princeton University Press) were excellent sites for networking, especially for junior scholars. The 2022 iteration of this conference will hopefully feature local viewing nodes again, which will further solidify the many networking opportunities this conference model can offer.

Distribute2020 was supported by the following people at U of T: Andrea Muehlebach (Department of Anthropology) is a board member of the Society for Cultural Anthropology and was a member of a 5-person organizing team distributed across 5 institutions in three countries. Other important partners in this conference were John Robinson and Dione Dias (CECCS), Avi Hyman, Peter Cheung, and James McAllister (Academic and Collaborative Technology); Stephen Marks (Digital Librarian, Robarts Library); Janice Boddy (Chair, Anthropology); Elizabeth Parke (Collaborative Digital Research Space, OVPR at UTM); Kent Moore (Vice-Principal Research, UTM). Farzaneh Hemmasi (Faculty of Music) and Margaret Wall (Communications and Research Librarian; Robarts Library) were also active in initial meetings.

All conference materials will continue to be stored on U of T's MyMedia space and will continue to be accessible via U of T's conference domain. *Distribute2020* will serve as a case-study and experiment to enable the ICT capabilities of the U of T campus for this purpose. This case-study will reveal any technical shortcomings of ICT at U of T and illustrate the path forward to develop the necessary infrastructure to support virtual conferencing. It is crucial to note here in this regard that Distribute2020 hinged significantly on collaboration with University of California Santa Cruz technology, which provided the platform for the panel-stream (via Ustream).

The sustainability recommendations by the CECCS to quantifiably and significantly reduce air travel and promote virtual conferencing are especially relevant under the recent development of the COVID-19 pandemic. The CECCS is committed to maintaining a focus on the sustainability aspects of hosting virtual events, including creating a guide to assess the life-cycle analysis of virtual events.

Supporting ICT Use

Beyond establishing an ICT infrastructure at U of T to support virtual conferences, we foresee a need for training and support for conference organizers and attendees. Connections have been made with Vinita Haroun and Amanda Pullan from the newly created Centre for Research & Innovation Support (CRIS), Laurie Harrison from the Information Online Learning Strategies portfolio part of Information Technology Services (ITS), Avi Hyman, Director of Academic & Collaborative Technologies, and Institutional Strategist for Academic Technologies in the Centre for Teaching Support & Innovation

(CTSI), and Helen Lasthiotakis, Executive Director, Research and Strategic Initiatives from the Office of the Vice-President, Research & Innovation (OVPRI). These offices are supporting the efforts of creating training workshops for faculty and staff on how to host and attend virtual conferences and meetings at U of T. Since COVID-19 has deemed it necessary for more virtually delivered material, there have been a lot of events and conferences that have become virtual. To bring the knowledge and expertise together, a community of practice Microsoft Team was created to share and work on virtual events and conference at U of T.

III) Developing A U of T Emissions Mitigation Program

Reducing air travel at U of T by developing virtual conferencing infrastructure is likely to be successful in mitigating an avoidable portion of the air travel emissions. However, some level of air travel will persist. Thus, it is important for U of T to develop a plan to mitigate those emissions. The following section on the Air Travel Emissions Mitigation Initiative stems from the proposal created by the Sustainability Office, St. George campus, under the direction of Ron Saporta, Chief Operating Officer, Property Services and Sustainability, and Kenneth Corts, during his term as Acting Vice-President, OREP, with the support of the Tri-Campus Sustainability Board.

Air Travel Emissions Mitigation Initiative

Operations and Real Estate Partnerships (OREP) is developing a bespoke air travel emissions mitigation initiative to accelerate U of T's emissions reduction efforts and to help mitigate University-related scope 3 emissions, beginning with air travel. This initiative is in line with "green" air travel funds that have been implemented at peer institutions including University of California, Los Angeles (UCLA) and Duke University, and it is designed to allow U of T to take immediate action towards these goals while discussions and research concerning scope 3 emissions continue.

This pilot will apply to all air travel by the President, Vice-Presidents, Assistant Vice Presidents, and Deans, as well as other senior leadership in their offices including senior administrative staff and all Vice-Provosts, Vice-Deans, and Associate Deans. All covered air travel will be assessed an air travel carbon mitigation charge as follows and is visually represented in **Figure 5**:

- **U of T Air Travel Emissions Mitigation charge for short/medium-haul flights:** $15 CAD per North American round-trip flight (double for business class at $30). The majority of the North American destinations from Toronto fall into the short or medium-haul flight category (less than a 6-hour direct flight or less than 3,700 km one-way). The average and median cost to offset emissions with CSA Standard-Certified Canadian Offsets for flights to common academic travel destinations were calculated (e.g. Anaheim, Atlanta, Vancouver, Boston, Philadelphia, etc.). The $15 selected price point falls within the range of offsetting a flight to New York (about $4.50 CAD) and Los Angeles (approximately $27 CAD). The penalty to shorter distance flights in this range was considered reasonable as they result in larger emissions per kilometer travelled and often have more low-carbon alternatives available, such as travel by train or bus, and easier video conferencing capacity (e.g. similar time-zones).

- **U of T Air Travel Emissions Mitigation charge for long-haul flights:** $65 CAD per round trip flight beyond North America ($130 for business class). The majority of the destinations outside of North America fall into the long-haul flight category. Similarly to the method used above, the average and median cost to offset emissions with CSA Standard-Certified Canadian Offsets for flights to popular regional hubs for university-related business were calculated (e.g. Paris, Frankfurt, Copenhagen, Shanghai, Mumbai, etc.). The $65 price point falls within the range of offsetting a flight to Paris (about $45 CAD) and Shanghai (about $116).

Business Officers in each unit will ensure that appropriate transfers are made to a central fund on a quarterly basis. These funds will be invested in projects identified and prioritized by the Tri-Campus Sustainability Board for their respective campuses. The Tri-Campus Sustainability Board, co-chaired by the Chief Operating Officer and Chief Planner, is made up of Chief Administrative Officers of University of Toronto Mississauga (UTM) and University of Toronto Scarborough (UTSC), operations staff and Sustainability Offices from the three campuses, and University Planning, Design and Construction staff. The results will be verified as part of U of T's annual emissions audit, completed by a third-party emissions auditing firm certified by the provincial Ministry of Environment, Conversation and Parks (e.g. KPMG, Deloitte, Dillon Consulting etc). See **Figure 6** for the program framework.

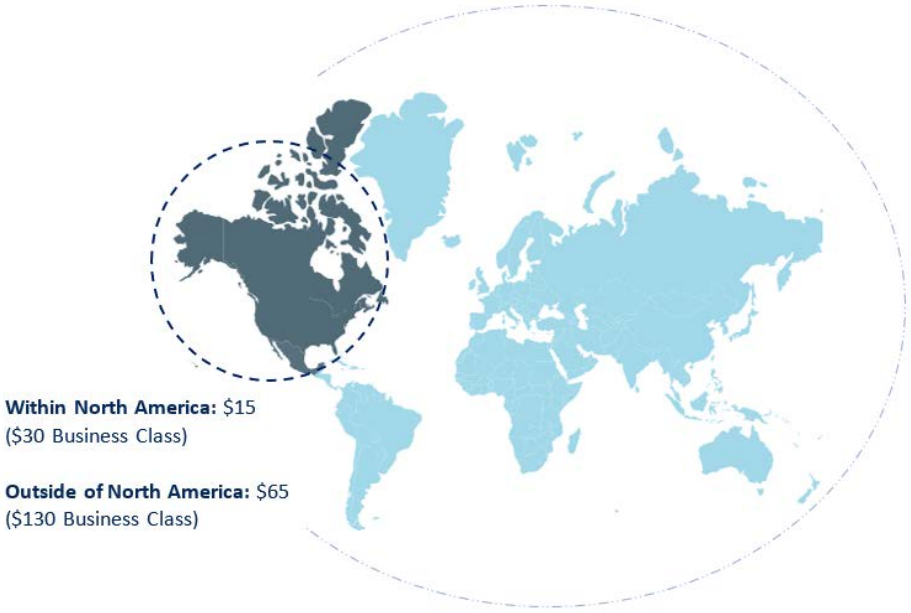


Figure 5: *Funding structure of the Air Travel Emissions Mitigation Program at University of Toronto by destination and flight class.*

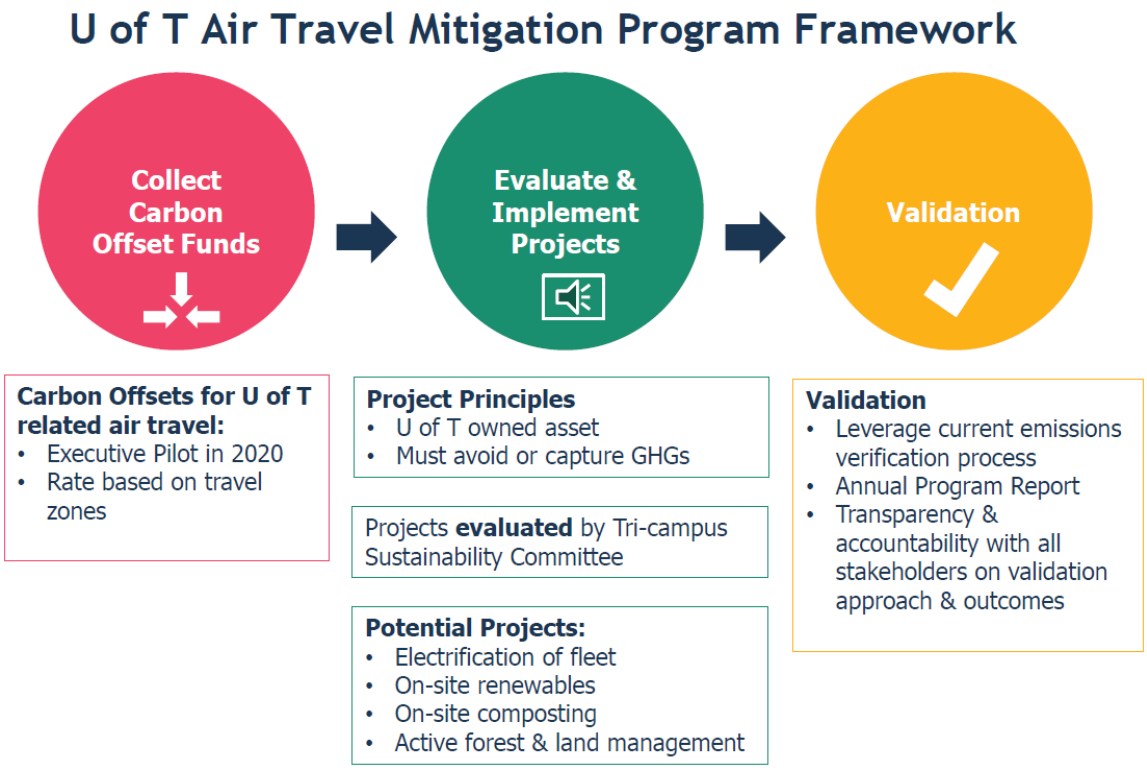


Figure 6: *University of Toronto Air Travel Emissions Mitigation Program Framework.*

Examples of immediate projects for U of T under the Air Travel Emissions Mitigation pilot include:

- On-site composting - Reduce emissions from transport of waste and purchasing of compost
- Electrification of fleet - Conversion of landscaping equipment and campus vehicles to electric
- On-site renewables - Solar projects on U of T properties not covered under existing funding structures
- Energy efficient projects that do not meet Utilities Reduction Revolving Fund - Ultra Low Temperature Freezers
- Active forest & land management - Promote active forest management strategies to quantify, plan and identify further opportunities to maximize carbon sequestration and storage by trees on U of T properties with expertise from U of T forestry researchers

The Ethics of Carbon Offsets

At the December 2019 Committee meeting, several members of the CECCS raised concerns regarding the ethics behind the use of carbon offsets to mitigate emissions. To address this, the CECCS had several student Research Assistants undertake a limited literature review on the main ethical arguments for and against carbon offsetting. The following section outlines main findings and discusses their application to the Air Travel Emissions Mitigation Initiative pilot proposed by OREP.

Literature Review

To understand the ethical implications of using carbon offsets to address scope 3 air travel emissions, a limited literature review was conducted. A total of 17 research articles, Non-Governmental Organization publications, and blog posts were reviewed on the ethical dimensions of carbon offsets, of

which, more than two thirds were from institutions in Europe, largely in the UK. This is partly because the European Union made the Kyoto Protocol Clean Development Mechanism (CDM) for carbon offsetting a central part of its Emissions Trading Scheme (ETS) 2020 emissions reduction plan, and the CDM was the biggest and most established offsetting mechanism in the decade 2000-2010 (Friends of the Earth, 2009). In addition, the UK government has attempted to regulate the market for voluntary carbon offsets (Lovell, 2010). However, most literature suggests that these early carbon offset programs have fallen significantly short of their promise. A 2016 report commissioned by the EU found that 85% of offset projects under the CDM have failed to reduce emissions (Cames et al., 2016), and some literature acknowledges that the EU's ETS was poorly implemented (Lovell, 2008b).

More recent experience paints a different picture. One member of the committee is active in United Nations Framework Convention on Climate Change negotiations and strongly supports offsets and other market mechanisms as an effective, efficient and ethical means of both mitigating and adapting to climate change. The member notes that Articles 5 and 6 of the Paris Agreement and the Intergovernmental Panel on Climate Change science also supports offsets as one of many tools in a transition to a lower carbon economy. Article 5 supports the REDD plus (Reduced Emissions from Deforestation and Destruction with particular focus on respecting indigenous and local community needs. The preponderance of domestic and global offset projects have resulted in measurable climate, environmental, community, and additional sustainability benefits. The International Civil Aviation Organization has also adopted a globally endorsed and independently supported, offset mechanism in order to assist with the transition to lower carbon aviation through CORSIA, its Carbon Offsetting and Reduction Scheme for International Aviation.

The ethical debates on carbon offsetting can be organized into three areas: fundamental objection (ethics of environmental markets), outcome dependent (ethical challenge of assured emissions reductions), and neo-colonialist (ethics of existing inequalities) (Lovell, 2008a).

Fundamental objection: the ethics of environmental markets

Some critiques of carbon offsets stem from an objection to using economics and markets to address environmental problems (Lovell, 2008b). In this respect, carbon offsets have been criticized as being forms of indulgences, which refer to the medieval practice of buying indulgences from the Church for one's sins, as they permit growth to continue. According to this position carbon offsets are "fundamentally flawed" and therefore it doesn't matter whether they work (Friends of the Earth, 2009). For instance, one article argues that when offset projects are built, they stimulate development that leads to a net increase in emissions (Anderson, 2012). However, it is suggested that the risk of such a "rebound" effect is low and could be avoided by benchmarking emissions (Kim and Pierce, 2018). Another common argument against the carbon offset market is that it does not create an incentive to implement policies and transition to new technologies and behaviours that reduce emissions (Anderson, 2012; Bachram, 2004; Brown, n.d.; Friends of the Earth, 2009). In this respect, carbon offsets centralize the main responsibility of changing consumption patterns to the individual and do little to encourage political and economic institutions to alter their own behaviour (Smith, 2007). Smith (2007) raises further concern that the financialization of carbon emissions is a form of greenwashing as businesses try to convince their customers to buy carbon offsets rather than reducing their consumption, which would affect the business' profits.

Outcome dependent: the ethical challenge of assured emissions reductions

Further critique of carbon offsets focuses on the ethics of assured outcomes for emissions reductions (Lovell, 2008b). In the context of the Clean Development Mechanism and its underperformance in reducing emissions, several articles also conclude that offsets cannot generate the

reductions needed to meet climate targets (Anderson, 2012; Brown, n.d.; Friends of the Earth, 2009). In part, this argument questions whether it is possible to accurately predict future emissions reductions, especially for projects in other countries (Friends of the Earth, 2009; Lovell et al., 2009). For example, it has been argued that the simplistic calculations often made to quantify the amount of carbon avoided are poor estimates of actual emissions reductions (Smith, 2007). Smith states that one issue with emission reduction estimates is that the baseline contains uncertainty because it is based on a theoretically projected future scenario without the offset project, and another issue is that companies can manipulate these theoretical numbers to generate as many sellable credits as possible (2007). A broader ethical argument is that it is almost impossible to prove that offsetting projects would not have happened without the offset funds, and therefore that the project creates additional emissions reductions to offset the emissions produced (Friends of the Earth, 2009). Also, the long-term impacts of carbon offset projects are rarely studied and incorporated in the process of verification (Maryanski, 2015). Consequently, if an offset project's indirect effects create more emissions, it is not accounted for, thus resulting in the verification conclusions being distorted and inaccurate (Maryanski, 2015).

Neo-colonialist: ethical concerns of existing inequalities

Carbon offset projects that are implemented internationally, typically in the Global South, are questioned for the ethics of their missions to 'develop'. This ethical debate centres on the argument that offsets shift the moral responsibility for reducing emissions to countries in the Global South (Bachram, 2004; Brown, n.d.; Friends of the Earth, 2009; Lovell et al., 2009). In this context, emissions-producing behaviours are referred to as "indulgences" that are being allowed at the expense of communities in the Global South (Dhanda and Hartman, 2011; Lovell, 2008; Lovell et al., 2009; Smith, 2007). However, Kim and Pierce argue that carbon emissions are not inherently bad, because if they could all be offset then we would not have a changing climate (2018). In addition, there is concern that many projects have negative impacts on the communities in which they are located, and community members are not consulted for the development (Brown, n.d.; Friends of the Earth, 2009; Lovell et al., 2009). Another concern is that carbon offsets allow those who can afford to pay for the additional expense to continue to consume at the same rate (Smith, 2007).

Discussion of findings

In response to the critiques outlined above, Lovell (2009) suggests that there are three narratives told by carbon offset organizations in support of offset mechanisms. The first narrative emphasizes that offsets are a "quick fix for the planet," focusing on quick returns and positioning climate action as part of an ordinary world of ethical consumerism. The second narrative emphasizes that carbon offsets enable "global-local connections" for climate action, advertising an ability to connect projects around the world and obtaining competitive advantage while doing so. The final narrative emphasizes that offsets can help "avoid the unavoidable" emissions that society will never be able to mitigate. It is a rational appeal to emissions accounting, and positions offsets as a strategy to govern the "consuming self," along with behaviour changes and efficiency improvements.

The fundamental objection to using carbon offsets as a climate mitigation strategy is part of a broader debate in environmental economics about assigning a market value to environmental resources, and about the desirability or possibility of continued economic growth. The first of these objections implies that GHG emissions cannot be assigned a monetary value, which once paid, will contribute to the removal or reduction of an equivalent amount of emissions. It is worth considering, then, whether the same argument should be held for other carbon pricing schemes such as a carbon tax or cap and trade system. If carbon pricing schemes are accepted in principle, then the argument that carbon offsets do little to enact institutional behaviour change suggests that the price of (mandatory) offsets is simply not high enough to disincentivize emissions-producing behaviour.

The argument about the need to constrain or eliminate economic growth has fostered a large literature over a number of decades. Proponents of green growth argue that carbon emissions (and other environmental impacts) can be decoupled from economic growth, while others argue this is an illusion and ultimately, we need to adopt some form of steady-state economy approach to avoid breaching fundamental ecological limits. This raises fundamental questions which go well beyond the carbon offsets issue. However, it could be argued that, if a limits to growth approach is in fact adopted, offsets may still be required to compensate for already existing emissions.

The argument that offsetting projects in the Global South should not be pursued because they spur a "rebound" of development suggests that the Global South should not invest in increasing economic development because more emissions would be produced as a result. It also assumes that offsetting projects themselves cannot be an important part of overall sustainability strategies in the South. These arguments raise important international equity issues. They have given rise to a large literature on the international and intranational equity implications of various forms of environmental policy. Although easy answers do not exist, ethical questions regarding the social, environmental, and economic consequences of development projects must be a concern for U of T air travel.

Concern about actual emission reductions from offset projects is important. If offsets do not create the promised emissions reductions, they compromise the climate action plans of which they are a part. However, these criticisms are centered on the Clean Development Mechanism and offset programs offered by profit-driven organizations. This is not a concern for U of T air travel, which will be discussed further in the recommendations.

Labelling carbon offsets as "indulgences" implies that carbon-emitting activities are inherently bad. An alternative view is that many emissions-producing activities, including flying, are not inherently bad and should be acceptable if the emissions can be actually and completely offset. Emissions-intensive forms of consumption and production certainly create other problems of social, environmental, and economic importance and these should be addressed. However, from the perspective of greenhouse gas emissions, the basis for evaluating the impact of a chosen activity should focus on lifecycle emissions.

This literature review on carbon offsets was a time-limited study undertaken by student RAs, and does not purport to be a comprehensive review of the literature. In particular there was not the opportunity to compile and review the substantial grey literature that has appeared in recent years on experience with offset programs.

Criteria for robust carbon offsets

A working paper on carbon offsets for scientific societies by Kim and Pierce (2018) provides an overview of carbon offset vendors, offset project types, pricing of commercial offsets, and concerns about offsetting emissions. The authors recommend carbon offsets as a short term or partial strategy for climate mitigation by institutions. Four basic criteria of robust carbon offsets are identified:

1. **Additionality**: it must be shown that emissions reduction projects would not have happened without the offset financing.
2. **Permanence**: carbon offset projects must be guaranteed to remain in-place and operational for the lifecycle accounted for in emission reduction estimates. This is particularly important for projects to plant trees, where there is a risk they may be harvested prematurely.
3. **Absence of leakage**: it must be assured that emissions mitigated do not simply occur somewhere else; for instance, forest conservation resulting in a different forest being logged
4. **Verification**: the above criteria must be confirmed by an independent and credible authority.

Ethics applied to the Air Travel Emissions Mitigation Initiative at U of T

The U of T Air Travel Emissions Mitigation Initiative put forward by U of T Operations and Real Estate Partnerships addresses many of the ethical concerns found in the literature about carbon offsetting. Unlike other offset programs, the initiative is designed to incentivize lower-carbon behaviours and mitigate emissions by supporting no-travel and low-carbon travel alternatives before imposing an air travel charge. In addition, it is unlikely that there is any incentive to use the mitigation initiative as an excuse to continue air travel because the University does not directly profit from air travel they pay for. However, it should be noted that international travel is informally (and in some cases formally) viewed as an indicator of academic success. Reducing air travel therefore challenges institutional norms about academic careers.

The proposal to locate mitigation projects on U of T property addresses several ethical concerns. Estimated emissions reductions are likely to be achieved because university staff will be able to monitor the performance of reduction projects, and these estimates will also be audited by a third party. Meanwhile, there is a very low likelihood that on-campus projects will spur a rebound of further development because of the spatial and economic constraints to growth at U of T, as well as the constraints created by the University's commitment to reduce emissions by 37% by 2030. Locating offset projects locally also addresses the critique that market offset projects located in the Global South continue patterns of neo-colonial development. Finally, the proposal acknowledges that efforts to avoid or reduce air travel emissions should be prioritized and that the air travel charges do not provide a simple moral absolution for the 'indulgence' of air travel emissions.

Although the Air Travel Emissions Mitigation Initiative does not suggest it will achieve one-hundred percent carbon offsets, it is recommended that the initiative seek to achieve the four criteria for robust carbon offsets proposed by Kim and Pierce (2018). The current proposal addresses each criteria to varying degrees. First, on-campus projects are very likely to be permanent because the university has direct control to ensure that the project achieves its full lifecycle of emissions reductions. Second, the proposed mitigation projects are unlikely to create carbon leakage because the mitigation efforts mostly focus on the University's scope 1 and 2 emissions. Large sources of scope 1 emissions at the University are space heating, on-campus transportation, and district energy generation. Transitioning to lower-carbon energy sources for these end uses, including Ontario's grid electricity, should not create carbon leakage if net lifecycle emissions of these sources are considered. Similarly, net lifecycle emissions accounting will assure leakage does not occur from scope 2 reductions. Third, the projects will be verified by a third-party auditor through the University's annual emissions audit, addressing concerns that the University will be held accountable to the promised reductions.

The proposal addresses the fourth, and last, criterion for robust offsets, additionality, to a limited scope. The examples of immediate emissions mitigation projects in the proposal would create additional reductions (as desired) because they are not covered under current funding sources. However, two considerations should be settled for establishing future projects. First, the University should consider the lifetime over which emissions are discounted. For example, the Government of Canada has made a commitment to become carbon neutral by 2050. Efforts are underway to put U of T on a path to be carbon neutral by 2050. Assuming U of T formally commits to this national goal across its three campuses, emissions reductions from mitigation measures should not be counted past this date, as the University can reasonably be expected to be near-zero carbon by then. Secondly, rigorous forecasting analysis should be conducted for any new mitigation measure to determine if it could be expected to be completed before 2050, and emissions should only be accounted for during this reduced period. It is recommended that third-party verification is obtained to assure the additionality of all mitigation projects. Another possible way to guarantee the additionality of mitigation measures is to focus on reducing other scope 3 emissions.

There is currently no institutional program for addressing scope 3 emissions, as noted in the introduction, so these emissions are guaranteed to be additional.

While the proposal is not labelled an air travel offsetting program, it is recommended to aim to completely offset unavoidable air travel emissions wherever possible, and it is strongly recommended that quantified reduction targets for emissions are set. Such reduction targets could be a percentage of air travel emissions and they may need to be developed and adjusted over time as funding and availability of projects change. It is broadly acknowledged that emission reduction programs without quantified targets are significantly less impactful because targets are needed to create emissions reduction strategies and to maintain accountability. If the proposal does not set targets to offset all or a high percentage of air travel emissions, there is a risk that it may become an ineffective climate action strategy.

Conclusion and Looking Forward

This report outlines the research and collaborations undertaken by the CECCS over several months to generate a preliminary plan of addressing scope 3 air travel emissions. University of Toronto's response to mitigating scope 3 air travel emissions encompasses the three prongs described above.

In the coming months, the following developments are expected on the three fronts.

1) Quantifying Air Travel Scope 3 Emissions

While the students from ENV461/1103 tested a methodology to estimate U of T's air travel emissions from incomplete and distributed datasets, their research highlighted the need for centralized and representative air travel records at the University to enable accurate calculation of GHG emissions from aviation. To pilot these efforts, the Air Travel Emissions Mitigation Program by University Operations and Real Estate Partnerships was set to collect travel data from the participating offices in 2020. At present, the implementation of the pilot is contingent on a return to air travel that has been halted as a result of the COVID-19 pandemic. Nonetheless, an internal information collection infrastructure will be tested during this pilot with the help of the U of T Central Finance Team to test for eventual University-wide application.

2) Reducing Business-Related Air Travel

Many policy and behaviour changes are recommended to mitigate air travel emissions. Adoption of any of these will bring much needed attention to this issue on campus. However, the main focus of mitigating travel, at the moment, remains to be supporting the development of virtual conferencing infrastructure at U of T. Through the continued support of *Distribute2020* and collaborations with various offices across campus, the CECCS hopes to create a) an example of a near-carbon-neutral conference at the U of T and b) demonstrate the capacity of U of T's conferencing technology to increase adoption of such practices. Additionally, using the *Distribute2020* conference as an opportunity, the CECCS along with conference organizers will quantify emission savings from avoided travel. A report on learning and findings can be expected in summer 2020. Lastly, in light of the COVID-19 pandemic, more lectures, meetings, workshops and conferences were held virtually. We hope to learn from this fast transition by developing a resource documenting best-practices at the U of T.

3) Developing an air travel emissions mitigation program

The Air Travel Emissions Mitigation Initiative Pilot was approved retroactively from January 2020 until the end of the academic year in August 2020. Air travel data will be collected for a six-month period, though time periods analyzed may vary from the initial January to June study plan due to the impacts of COVID-19 on air travel and university operations. This Pilot is an important case study at U of T. With the eventual objective of University-wide adoption, the project will monitor and assess its

strengths and impact in the pilot period. A report on its outcomes can be expected upon the conclusion of the pilot period.

The CECCS supports strong action by U of T related to the mitigation of air travel scope 3 emissions. The Committee looks forward to working with the relevant offices and key actors to further the progress on all three fronts outlined in the report in the coming months.

The Committee recognizes that should the recommendations on these three fronts be accepted, this will require a further investment of resources. Some of the recommendations, particularly the trip reductions and the need to expand the infrastructure that enables the alternative arrangements, call for a cultural shift and support for the need to direct the appropriate level of resources for this significant responsibility of the University. The COVID-19 pandemic may have started the conversation into rethinking what travel is necessary and what can be accomplished virtually. Opportunities will arise to determine whether we will keep on this trajectory and reduce air travel or revert back to our original pre-pandemic course.

In closing, the Committee would like to thank the students, faculty, staff, who engaged with the process to produce this report. We are also thankful for the co-operation and support received from the central administration at U of T to undertake this study.

References

Anderson, K. (2012). The inconvenient truth of carbon offsets. Nature, 484(7392), 7–7. doi: 10.1038/484007a

Arsenault, J., Talbot, J., Boustani, L., Gonzalès, R., & Manaugh, K. (2019). The environmental footprint of academic and student mobility in a large research-oriented university. Environmental Research Letters, 14(9), 095001.

Bachram, H. (2004). Climate fraud and carbon colonialism: the new trade in greenhouse gases. Capitalism Nature Socialism, 15(4), 5–20. doi: 10.1080/1045575042000287299

Brown, V. (n.d.). Carbon Offsets Do Not Work. Retrieved February 3, 2020, from https://www.responsibletravel.com/copy/carbon-offsets

Burian, I. (2018). It is up in the air. Academic flying of Swedish sustainability academics and a pathway to organisational change. Lund University.

Cames, M. O., Harthan, R. M., Füssler, J., Lazarus, M., Lee, C., Erickson, P., & Spalding-Fecher, R. (2016). How additional is the Clean Development Mechanism? (p. 11). Berlin: Öko-Insitute.V.

Davies J, Dunk R (2016) Flying along the supply chain: accounting for emissions from student air travel in the higher education sector Carbon Management Vol. 6, 1-14

Dhanda, K. K., & Hartman, L. P. (2011). The Ethics of Carbon Neutrality: A Critical Examination of Voluntary Carbon Offset Providers. Journal of Business Ethics, 100(1), 119–149. doi: 10.1007/s10551-011-0766-4

Dunk, R. M., Mork, J., Davies, J., Davidson, J., Paling, C., Hindley, J., ... & Tinker, H. (2017). Taking responsibility for carbon emissions-The evolution of a Carbon Literacy Living Lab. Environmental Scientist, 26(4).

Friends of the Earth. (2009). A Dangerous Distraction. Friends of the Earth England, Wales and Northern Ireland. Retrieved from https://foe.org/resources/a-dangerous-distraction/

Grant, N., Salvi, P., Thomas, C., Warwick, L., Schoenrock, E., Robertson, S., ... & Olympios, A. (2019). Aviation Emissions at Imperial College, London: Current Status and Policy Recommendations.

Kim, R. and Pierce, B. (2018). Carbon Offsets. An Overview for Scientific Societies. Retrieved from https://www.cis.upenn.edu/~bcpierce/papers/carbon-offsets.pdf

Lewis T (2013) A Life Cycle Assessment of the Passenger Air Transport System Using Three Flight Scenarios. In: Department of Energy and Process Engineering: Norwegian University of Science and Technology)

Lovell, H. (2008a, June). The Ethics of Carbon Offsets. Presentation at Carbon and Communities in Tropical Woodlands an International Interdisciplinary Conference, Edinburgh, UK. Retrieved from: https://www.eeo.ed.ac.uk/abs/MiomboConference/HLa.pdf

Lovell, H. (2008b). The Ethics of Carbon Offsets. In Carbon and Communities in Tropical Woodlands an International Interdisciplinary Conference (pp.83-85). Edinburgh: University of Edinburgh. Retrieved from: https://www.eeo.ed.ac.uk/abs/MiomboConference/

Lovell, H. C. (2010). Governing the carbon offset market. Wiley Interdisciplinary Reviews: Climate Change, 1(3), 353–362. doi: 10.1002/wcc.43

Lovell, H., Bulkeley, H., & Liverman, D. (2009). Carbon Offsetting: Sustaining Consumption? Environment and Planning A: Economy and Space, 41(10), 2357–2379. doi: 10.1068/a40345

Maryanski, H. (2015). The Ethics of Carbon Offsets. Retrieved from https://www.scu.edu/environmental-ethics/resources/the-ethics-of-carbon-offsets/

McGill University (2017) Greenhouse Gas Inventory. https://www.mcgill.ca/facilities/files/facilities/ghg_inventory_report_2017.pdf

Smith, K. (2007). The carbon neutral myth: offset indulgences for your climate sins. Retrieved from http://www.carbontradewatch.org/pubs/carbon_neutral_myth.pdf

Wynes and Nicholas (2019), “Flying Less is Critical to a Safe Climate Future,” Public Administration Review: https://www.publicadministrationreview.com/2019/07/16/gnd24/

Wynes, S., Donner, S. D., Tannason, S., & Nabors, N. (2019). Academic air travel has a limited influence on professional success. Journal of cleaner production, 226, 959-967.

Appendices

Appendix 1: ENV461/1103 Student Report on “Quantifying Business-Related Air Travel Emissions: September 2018 to September 2019”

Appendix 2: Assigning Institutional Responsibility for Business Air Travel at U of T--Tally of Approaches

Appendix 3: Literature on Virtual Conferencing

Appendix 4: Menu of Options for Virtual Conferencing

Appendix 5: Air Travel and Scope 3 Emissions at Other Institutions using GHG Reports

Appendix 1: ENV461/1103 Student Report on "Quantifying Business-Related Air Travel Emissions: September 2018 to September 2019"

Quantifying University of Toronto Business-Related Air Travel Emissions: September 2018 - September 2019

Amine Mikati, Anne Boucher, Juna Borras, Robin Tobazian, Rylan Urban, and Weilin(Daniel) Li
ENV461/1103
December 6, 2019

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Executive Summary

The University of Toronto's Committee on the Environment, Climate Change, and Sustainability (CECCS) tasked our student group, Gas Busters, to calculate the UofT's total greenhouse gas emissions released from business-related air travel. Business-related air travel is defined as any air travel made by students, faculty, staff, or visitors that was paid for or reimbursed by the UofT.

Throughout the 2019 fall academic semester, our group collected flight and financial data through the UofT finance department, the UofT travel booking agency, and surveys. This data, combined with government-reported emissions factors allowed us to calculate UofT business-related air travel emissions in two separate ways, giving us an emissions range. The first, top-down approach, used aggregated flight and financial data and produced a final number of 26,028 tCO_2e. The second, bottom-up approach, relied primarily on survey data and produced a final number of 57,838 tCO_2e.

Gas Busters was successful in reporting the business-related air travel emissions for the UofT for the period of September 2018 to September 2019 to be 26,028 and 57,838 tCO_2e. The emissions calculation spreadsheet and survey template have also been provided to the client as a deliverable, allowing the CECCS to continue work on calculation business-related air travel emissions in the future.

Our group faced some challenges in analyzing the findings of this report, mostly with obtaining high quality data. The limitations of these challenges are discussed, along with our recommendations for the project moving forward.

Project Scope

Introduction

In 2017, the University of Toronto (UofT) formed its CECCS in response to the Report of the President's Advisory Committee on Divestment from Fossil Fuels. Since then, the University of Toronto (UofT) has become a member of the University Climate Change Coalition (UCCC), a group of universities committed to reducing their carbon footprint. As part of this larger ambition towards addressing climate change and greenhouse gas (GHG) emissions, the UofT is now questioning the impact of its Scope 3 emissions and, more specifically, emissions from university business-related flights. Scope 3 emissions are defined as emissions from sources not owned by the university, but that are related to the company's operations or activities (Protocol, G. G., 2011). Currently, the UofT does not have a consolidated program to collect data or calculate Scope 3 emissions. Therefore, as part of the UofT's commitment to reducing carbon footprint, this project aimed to quantify emissions from business-related air travel made by faculty, staff, visitors or students that was paid for or reimbursed by the UofT.

Key Questions and Deliverables

In order to achieve this goal, we have considered the following questions: What business-related air travel data do we need to collect? Where is this data located, and what is the best way to collect this data? How do we calculate GHG emissions from this data? Finally, what are the UofT's total business-related air travel emissions?

Our main goal was to conduct the following: collect all required data, determine an emissions calculation of said data, quantify the university's total business-related air travel emissions over a specified timeframe, provide the CECCS with a standardized method to calculate business-related emissions from raw air travel data, along with a survey template and an annotated bibliography of relevant university air emissions studies.

Methodology

Defining Business-Related Air Travel

University business-related air travel is defined as any air travel made by students, faculty, staff, or visitors that was paid for or reimbursed by the UofT. This definition was chosen based on the availability of data and is supported by approaches of other universities such as UCLA (Kwan, 2008) and UBC (Wynes, 2018). For clarification, the table below offers examples of common flights, and indicates which types are included in this definition and which types are not.

University Business-Related Air Travel	Not University Business-Related Air Travel
University of Toronto-Funded Flights: ● Conferences ● Workshops ● Research ● Sporting Events ● Visitor Travel Grant and Scholarship-Funded Flights Administered Through UofT ● Research, conferences, study abroad, etc.	Flights Directly Funded by Grants and Scholarships Not Administered Through UofT ● Research, conferences, study abroad, etc. Visitor-Funded Flights ● Conferences, events, research, etc. Personally-Funded Flights ● Consulting, trips home, events, etc. + Any other flight not funded by the University of Toronto

Data Sources

Throughout the duration of the project, we identified several sources for data collection. Each provided important information necessary for the quantification of business-related air travel.

Avenue Travel

The first source of data that we identified was Avenue Travel, the UofT's travel booking agency. We collected detailed data that included flights booked by university staff, students, faculty, and visitors. Key data collected collected from Avenue Travel included cost of flight, origin-destination, distance traveled, and cost per mile travelled for each individual flight. Reports generated by Avenue Travel were sorted into domestic, transborder, and international flight categories. Overall, Avenue Travel data showed a total of $2,959,553 in flight spending.

University Financial Records

The second source of data that we identified was the university's flight-related financial records. This data was obtained by the university via all relevant General Ledger (GL) codes. These records demonstrated the total amount of money that the UofT spent on flights for the period September 2018 to September 2019, and was sorted into several booking categories including staff, students, field trips, and conferences.

Emissions Factors

The third source of data that we used was flight emission factors from the Government of the United Kingdom's Department for Business, Energy & Industrial Strategy (Department for Business, Energy & Industrial Strategy, 2019). These emissions factors were selected for several reasons. First, their emission factors were best aligned with the data we could access, as they were normalized based on distance flown. Second, their emission factors took into account several important considerations including average flight occupancy rates, the elevation at which emissions are released, average

passenger class (i.e. economy, economy-plus, business, and first class), and the often indirect trajectories of planes when travelling.

The emissions factors as calculated by the Government of the United Kingdom are sorted into short-, medium-, and long- haul flights as defined in the table below.

Emission Factors		
Flight Classification	Trip Distance (km)	kg CO_2e/passenger km
Short-haul	<463	0.25493
Medium-haul	463-3700	0.15832
Long-haul	>3700	0.19562

As we can observe, the emissions factors intuitively decrease as the flights become longer, as longer flights usually have higher passenger to weight ratios, experience less air friction due to altitude, and experience less altitude-climbing time relative to its total flight time. However, long-haul flights actually have a slightly higher emission factor than medium-haul flights since emissions released at higher altitudes have a greater global warming potential.

Survey

The final source of data collection method we used was a survey. Our goal was to calculate the emissions through a different, 'bottom-up' methodology which is explained below. The survey was shared with the respective departments and faculties of the members of the CECCS, in addition to a few other departments in the UofT. Departments and faculties chosen had been deemed to be most likely to respond due to existing connections with our team and client. Both faculty and staff were deliberately included in the survey dissemination, while students were free to respond.

Calculation Methodology

Business-related air travel emissions were calculated using both a 'top-down' and 'bottom-up' methodology. This decision was made based on the availability of data and is consistent with the approach recently used by the University of British Columbia (Wynes et al., 2018).

The top-down methodology uses individual and aggregated flight data collected from Avenue Travel, the UofT Financial Services, and the aforementioned emissions factors. The bottom-up approach used data collected through the survey, Avenue Travel Data, the UofT Financial Services, and the emissions factors.

Top-Down Calculation Method

The Avenue Travel data was categorized into domestic, transborder, and international travel. Since the emissions factors were categorized differently (i.e. short-, medium-, and long-haul flights), we rearranged the data obtained from Avenue Travel to reflect the same categorization while maintaining its integrity. Based on the new arrangement, we obtained the total fare spent on flights, and the total

miles flown in each class. We then calculated the kilometre per dollar (km/$) value through the following formula:

km/$= 1.60934 (km/mile) * Total distance flown per flight class (miles)/ Total fare spent per flight class ($)

We also calculated the percentage spent on each flight class through the following formula:

% Spend = Fare spent per flight class/Total fare spent through Avenue Travel

To obtain the distance flown in each flight class, we followed the following formulas:

Short-haul Distance (km) = Short-haul spend ($) * Short-haul km/$

Medium-haul Distance (km) = Medium-haul spend ($) *Medium-haul km/$

Long-haul Distance (km) = Long-haul spend ($) *long-haul km/$

Lastly, we calculated the emissions from each flight class through the top-down approach through the following formulas:

*Short-haul Emission (kg CO_2e) = Short-haul distance (km)*Short-haul emission factor (kg CO_2e/km)*

Medium-haul Emission (kg CO_2e) = Medium-haul distance (km) Medium-haul emission factor (kg CO_2e/km)*

*Long-haul Emission (kg CO_2e) = Long-haul distance (km) * Long-haul emission factor (kg CO_2e/km)*

The results of these calculations are shown in the next section.

Bottom-Up Calculation Method

For this calculation method, we analyzed the data received through the survey. After conducting a survey for ten (10) days, we obtained a total of 79 responses which reported 115 round-trip flights flown. We gathered the origin and destination of all flights taken by the respondents. Through research, we found the distance traveled by each flight. To be consistent with the top-down approach, the flights were classified into short-, medium-, and long-haul flights. From the distance traveled, we calculated the emissions from the flights taken in the survey through the following formula:

*Short-haul Emission (kg CO_2e) = Short-haul distance (km)*Short-haul emission factor (kg CO_2e/km)*

Medium-haul Emission (kg CO_2e) = Medium-haul distance (km) Medium-haul emission factor (kg CO_2e/km)*

*Long-haul Emission (kg CO_2e) = Long-haul distance (km) * Long-haul emission factor (kg CO_2e/km)*

Simultaneously, we calculated the total cost spent on each flight class through the following formula:

*Total Spent per flight class($) = Average cost of ticket per flight class ($) * Number of flights per flight class (#)*

The average cost of tickets per flight class was taken from the Avenue Travel Data. With the above calculations, we then obtained the emissions per dollar spent for each flight class within the survey through the following formula:

Emissions per dollar spent per flight class (kg CO_2e/$) = Emissions per flight class (kg CO_2e)/ Total spent per flight class ($)

Following this, we used this emissions per dollar spent in each flight class on the financial data obtained from the UofT to calculate the emissions of the bottom up approach.

*Total emission (kg CO_2e) = Emission per Dollar (kg CO_2e) * Total Spent per flight class from Financial Data ($)*

Project Deliverables

Data Calculation Results

The first project deliverable was to calculate the total emissions produced by business-related air travel. The results from these calculations are presented below.

Top-Down Calculation Method

Using the methodology described in the Calculation Methodology Section, we determined that 54.7% of money is spent on long-haul flights, 43.1% on medium-haul, and 2.2% on short-haul. We also found that the distance traveled per dollar spent increases as the trip distance increases with 7.85 km/$ on long-haul flights, 5.75 km/$ on medium-haul flights, and 1.91 km/$ on short-haul flights.

Flight Breakdown - Avenue Travel		
Flight Classification	Relative $ Spent on Flights (%)	Distance per Dollar (km/$)
Short-haul	2.2	1.91
Medium-haul	43.1	5.75
Long-haul	54.7	7.85

According to the UofT's financial data, the total amount of money spent on flights from September 2018 to September 2019 was $20,943,371. The table below divides this into the flight categories based on the percentages obtained from Avenue Travel data. From it, we are able to determine the total distance flown in each category as long-haul: 89,908,395 km; medium-haul: 51,873,101 km; and short-haul: 893,345 km.

Flight Totals - University Financial Data

Flight Classification	Total $ Spent	Distance per Dollar (km/$)	Total km flown
Short-haul	466,819	1.91	893,345
Medium-haul	9,028,218	5.75	51,873,101
Long-haul	11,448,335	7.85	89,908,395

Finally, multiplying the distance with the emission factors, we were able to determine the total emissions in each category at 17,588 tCO_2e for long-haul flights, 8,213 tCO_2e for medium-haul flights, and 228 tCO_2e for short-haul flights.

Final Calculation			
Flight Classification	Total distance flown (km)	Emissions factor ($kgCO_2e/km$)	Total Emissions ($kgCO_2e$)
Short-haul	893,345	0.25493	227,740
Medium-haul	51,873,101	0.15832	8,212,549
Long-haul	89,908,395	0.19562	17,587,880
Grand Totals	**142,674,841**		**26,028,170**

Bottom-Up Calculation Method

Using the methodology described in the Calculation Methodology Section, we determined the total distance flown based on survey responses to be 1,850,802 km. The numbers sorted into the appropriate flight category are shown in the table below. Multiplying these numbers by emissions, we also calculated emissions for each category at 315 tCO_2e for long-haul flights, 38 tCO_2e for medium-haul flights, and 0.3 tCO_2e for short-haul flights.

Survey Emission Calculation			
Flight Classification	Total distance flown (km)	Emissions factor ($kgCO_2e/km$)	Total Emissions ($kgCO_2e$)
Short-haul	1,332	0.25493	340
Medium-haul	239,720	0.15832	37,952
Long-haul	1,609,750	0.19562	314,899
Grand Totals	**1,850,802**		**353,191**

The total number of flights, average fare per ticket, and total fares were calculated based on the methodology described and are shown in the table below. The results show that approximately $136,340 of air travel booking was captured through the survey, which represents just 0.65% of all business-related flights booked from September 2018 - September 2019 according to the UofT financial data.

Survey Cost Calculation			
Flight Classification	Total Number of Bookings	Avg. Fare per booking ($)	Total Fare ($)
Short-haul	7	402	2,814.7
Medium-haul	79	821	64,854.6
Long-haul	29	2,368	68,670.6
Grand Totals	**115**		**136,339.9**

Finally, we were able to determine the total emissions in each category at 52,498 tCO_2e for long-haul flights, 5,283 tCO_2e for medium-haul flights, and 56 tCO_2e for short-haul flights.

Total Survey Emissions Calculation			
Flight Classification	Emissions Intensity (kg CO_2e/$)	Total Spent ($)	Total Emissions (kgCO_2e)
Short-haul	0.121	466,819	56,318
Medium-haul	0.585	9,028,218	5,283,250
Long-haul	4.586	11,448,335	52,498,068
Grand Totals		**20,943,372**	**57,837,636**

Survey Template

The second project deliverable was to produce a survey template that could be used again to calculate business-related air travel emissions from a bottom-up approach. The questions that we used can be found in the appendix.

The survey questions were created based on the survey created by the University of California Los Angeles (Kwan, 2008) and with input from our client. In the final version of the survey, just three questions were included: 1) “What’s your role at the UofT?” was asked to understand who was answering the survey; 2) “Which academic division or administrative unit do you belong to?” provided us with a breakdown view in the perspective of divisions and units; and 3) “Please list the destinations for the flights that you remember taking in the past 12 months that were funded through the university” Allowed us to compare with the top-down approach.

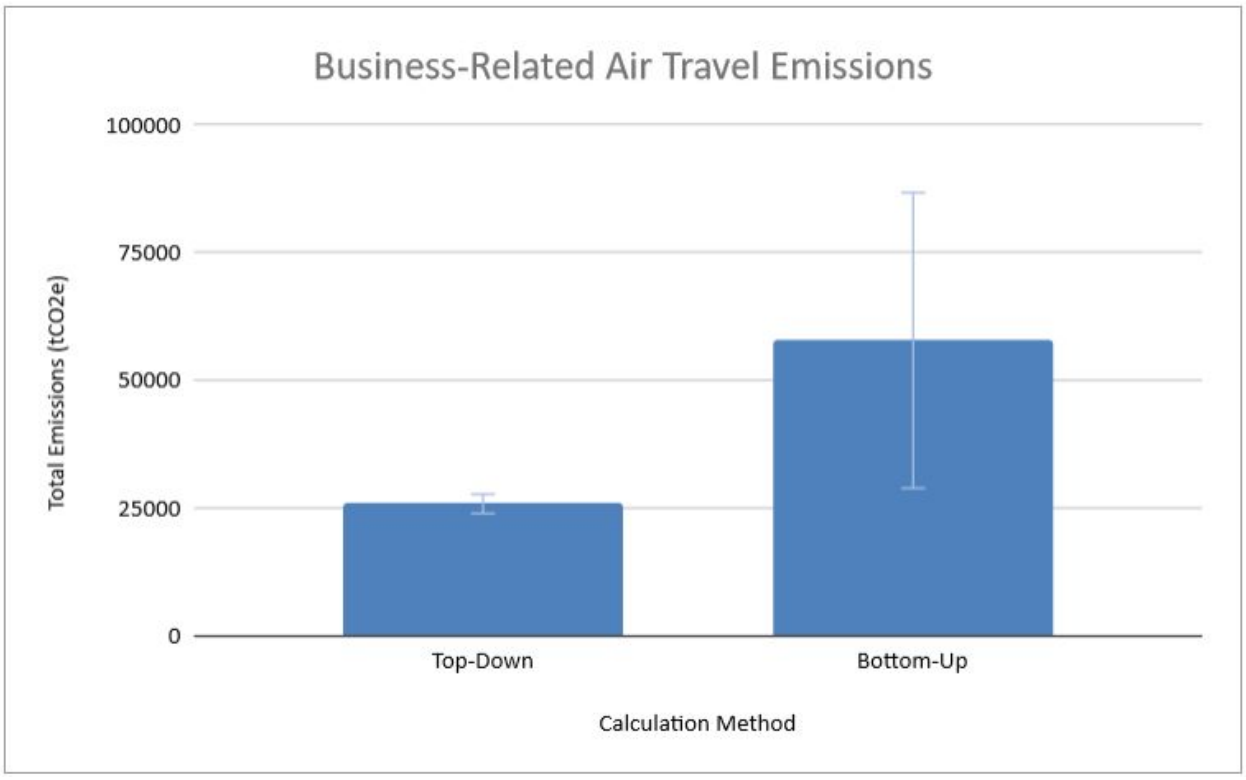
Emissions Calculation Spreadsheet

The final deliverable for this project was a standardized method to calculate business-related emissions from raw air travel data, through the form of a spreadsheet. This spreadsheet offers the CECCS the tools necessary to calculate the UofT’s emissions moving forward. It contains the raw data obtained from all sources, along with intact formulas that can be used to easily follow calculations and make further calculations in the future. This spreadsheet has been uploaded to a shared google drive with the client.

Key Findings

Total University Business-Related Air Travel Emissions

We determined business-related air travel emissions to be 26,028 t eCO2 using the top-down calculation method and 57,838 using the bottom-up calculation method. However, both of these methods also need to consider a margin of error based on the quality of data available. We've estimated a 10% margin of error in the top-down method because we did not have detailed flight information for all university flights and to account for possible manual entry errors when entering G&L codes into the financial data. We've estimated a 50% error in the survey responses to account for the extremely low number of responses which accounted for just 0.65% of the total money spent on bookings.



In our opinion, the survey results had too few responses to provide meaningful information and the top-down approach should be used as a best estimate for business-related air travel emissions.

Comparison to Other Universities

The flight emissions intensity of the UofT, based on the total number of staff and faculty, falls within the range of all universities that we compared. The exception is with the University of California Los Angeles,

where the UofT's emissions range is higher. However, these emissions are from 2008 years ago and thus may not be the best for comparison.

A more accurate comparison can be made by expanding the number of universities that are compared, by using more recent numbers, and by shrinking the UofT's emissions range by collecting more accurate data through the survey.

University Name	Year of Emissions Calculations	Total Business-Related Air Travel Emissions	Total number of Staff and Faculty	Flight Emissions Intensity
University of California Los Angeles	2007	5,883 to 21,839 tCO_2e	20,622	0.285 to 1.059 tCO_2e/person
University of British Columbia	2015-2016	26,333 to 31,685 tCO_2e	16,891	1.559 to 1.876 tCO_2e/person
University of Toronto	2018-2019	26,028 to 57,838 tCO_2e	21,788	1.19 to 2.65 tCO_2e/person
University of Edinburgh	2019	18,501 tCO_2e	9,324	1.984 tCO_2e/person

Conclusions

Ultimately, we evaluated the contribution of air travel that was funded through the university, including conferences, research, meetings, grants and scholarship to the environmental footprint of the UofT. The calculated carbon emission in this project is 26,028 tCO_2e to 57,838 tCO_2e. This is approximately 1.19 to 2.65 tCO_2e per university employee (faculty & staff). We also showed that the students, staff and faculty of the UofT had travelled great distances over the past year. For example, 55% of the trips taking place in this project are long-haul, which totals to over 89 million km. Our findings show that business-related air travel has become a central component of the university experience for many students, staff and faculty. However, this result is limited to one financial year. Therefore, determining whether our data is representative of a wider trend is difficult.

Nevertheless, a few other published results are directly comparable to our results. Other universities, such as the University of British Columbia (UBC) and the University of California, Los Angeles (UCLA) have also looked at their carbon emissions from air travel. For instance, UBC, an institution with 16,891 staff and faculty, calculated their emission to be 26,333 to 31,685 tCO_2e. This number is lower than our calculated emission since the UofT is a larger institution, with 21,788 numbers of staff and faculty. On the other hand, researchers from the UCLA, another research-oriented university of similar size (20,622 number of staff and faculty), calculated their emission to be 5,883 to 21,839 tCO_2e. These differences

can depend on many factors, including the size of a university, geographical locations, and the financial budgets of the university. Yet, in all cases, one thing is certain: business-related air travel represents a large proportion of universities' greenhouse gas emission burden.

Recommendations

To potentially reduce the environmental impact of air travel, we have proposed a few recommendations tailored to tracking and addressing greenhouse gas emissions from business-related air travel at the University of Toronto.

Comprehensive Data Collection

Centralize and Standardize University Data

First and foremost, it is crucial for the CECCS to gather higher quality data from the UofT in the future. Given the decentralized nature of air travel data collection, implementing a university-wide, standardized data collection method will be important. This could present itself as a form to be filled out by administrative staff, or in a way best suited for the UofT. Regardless of the method implemented, the CECCS should ensure the collection of all necessary data for the most accurate calculations (e.g. flight class, flight destinations, cost, etc.). This would allow emissions associated with air travel to be easily exported for future assessment, and would increase the accuracy of institution-wide emission reporting. Once this data becomes readily available, we can begin to observe trends over a long period of time, which we strongly recommend. Tracking air travel emissions from several financial years could determine whether the UofT's greenhouse gas emissions from air travel are increasing, decreasing, or relatively stable from year-to-year, and could identify which departments contribute to emissions the most for targeted interventions.

Conduct a Thorough Survey

In the meantime, strengthening the survey will be a strong practical step that can be completed. Increasing both the number of respondents in general along with the number of student respondents will give a fuller picture of the UofT's air travel emissions. Based on the UofT's number of staff, faculty, and students, we suggest a target of 1373 responses. This number represents approximately 6.3% of the total number of faculty and staff. The 6.3% is the average response rate on air-travel surveys conducted by other universities that were able to poll their entire faculty and staff population.

In addition, improving the precision of the survey options will better align responses with the other data collection methods; tightening origin-destination points, distinguishing between flight classes, and gathering dollar values are among some of the ways the survey can be improved. We recommend using

a more robust survey platform in the future, especially one that allows for more intuitive entering of origin and destination information, rather than into a blank field as the survey is in its current form.

Carbon Offset Program

Lastly, we recommend the implementation of a carbon offset program. While such a program may not eliminate the impact of the UofT's air travel, it can still work to reduce it. Assuming a carbon price of $30/tonne, the UofT could offset its 2018-2019 emissions at a cost of $780,840. Since we also know the UofT spent $20,943,371 on flight during this period, this would represent a 3.72% increase in the cost of booking. Depending on the flight class, this would add between $15 and $88 to the cost of a single booking.

Cost of Carbon Offset Program			
Flight Classification	Avg. Fare per booking ($)	Offset Cost per booking ($)	Total 2018-2019 Offset Cost ($)
Short-haul	402	15	17,405
Medium-haul	821	31	336,603
Long-haul	2,368	88	426,833
Grand Totals	**3,591**		**780,840**

Implementing a carbon offset program would allow the UofT to serve as a model for other large public institutions in playing an essential role in addressing their own business-related air travel emissions.

Quick Wins and Flight Alternatives

Reducing business-related air travel emissions at the UofT requires substantial shifts in individual behaviours. The most effective step would be requiring economy-class travel; in other words, the UofT should eliminate all non-economy ticket purchases. Individuals who are wishing to fly in a higher class or to upgrade their tickets could still to do so at their own expense so that the UofT is not accountable for the added increase in emissions. This would make a significant difference as first class emissions are 4 times that of economy class emissions and business class emissions are 2.9 times that of economy class emissions for long-haul flights (Department for Business, Energy & Industrial Strategy, 2019).

Moreover, for those who are traveling in short-haul flights (such as to Montreal, Ottawa, New York, etc), ground transportation using VIA-rail or a busing system is a great alternative. This would also make a significant difference as short-haul flights release the greatest amount of emissions per distance travelled and emit about 5 times the emissions compared to rail travel (VIA Rail Canada, 2019).

Project Challenges

Multiple Project Inputs

At the beginning of our project, we received incongruent input from multiple sources (our client, the course instructor, and course TA) which made it challenging to distinguish between what the expectations were from our group. This resulted in actions that were unintentionally misaligned with our client's expectations . In order to avoid future incidents of miscommunication, the Gas Busters made an effort to write clear emails to our client outlining the group's next steps, and implemented the practice of waiting for a written go-ahead from the client before advancing. We felt that by the end of the project almost all input was made from our primary client contact, Dione, which made progressing without conflict a lot easier.

Difficulty Accessing Data

Midway through the project, awaiting for requested data proved to be challenging. We could not move ahead until data was in our hands. Avenue Travel was difficult to reach, and the data provided by the university via GL codes was insufficient on its own to calculate GHG emissions accurately. To remedy this, it was mutually decided that it would be our client's responsibility to reach Avenue Travel, as we were relying on their data to move forward. We recognized that correspondence from the client would be perceived as more credible in the eyes of the company, and would thus increase our chances of receiving any data. Though data was still slow to come in, this strategy proved successful.

Lack of Data Availability

Overall, while the Avenue Travel data was in fact beneficial, we were not able to collect all data necessary for the *most* accurate calculation possible. The unfortunate truth is that the university's decentralized nature means that air travel data is scattered throughout departments and faculties, and is collected in a variety of ways (if at all). While we could not resolve this issue within our time frame, our aforementioned recommendations will assist the CECCS in gathering this data. All in all, the Gas Busters proved to be capable to improve on issues that were within our control. Of course, some of the limitations could not be solved within a short semester. Still, we are hopeful that the CECCS will be able to move forward and address this.

Technical Limitations

By far, the largest technical limitation of this project related to incomplete datasets.

Incomplete Individual Flight Data

In the top-down method, the percentage of dollars spent on each flight class was extrapolated from Avenue Travel to the total amount spent on flights from UofT financial data. However, Avenue Travel data represented only 14% of total university spending on air travel.

The impact of this limitation on the top-down approach is moderate, and is equally likely to skew the final results in both the positive and negative direction. Since not all travel is booked through Avenue Travel, this limitation can only be resolved by collecting complete flight information at the university level.

Limited Survey Results

Due to a variety of factors (a 10-day window, and no access to email listservs) the survey received 79 responses. These responses represented only 0.65% of the university's total spending on flights and thus an extremely high degree of variation in the bottom-up approach is to be expected. However, unlike the incomplete individual flight data, these responses are more likely to be skewed in the positive direction. We are making this assessment based on three factors. The factor is due to response bias - we assume that people were less likely to open and fill-out the air travel survey if they have never travelled by air for the university. Second, the total emissions results from this method are 25% higher than the next highest university that we compared to.

The impact of this limitation can be reduced by taking our recommendation to gather at least 1373 responses, which is the most one would reasonably expect given the current total number of faculty and staff at the UofT and our research on flight survey response rates at other universities.

Time Frame Misalignments

Data from Avenue Travel, UofT Financial Services, and the survey were all collected for a 1-year timeframe. However, this time frame did not overlap perfectly. Avenue Travel data was representative of the period of October 1st 2018 to September 30th 2019, UofT Financial Services was representative of the period of September 1st 2018 to September 1st 2019, and survey data was representative of the 12 months immediately preceding the taking of the survey - roughly from November 20th 2018 to November 20th 2019. The misalignment of these dates creates additional uncertainty in our numbers, but is unlikely to skew them in one direction or the other given that they all observed a relatively similar period of time.

Bibliography

Department for Business, Energy & Industrial Strategy (2019). *Greenhouse gas reporting:conversion factor 2019.* Retrieved from: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019

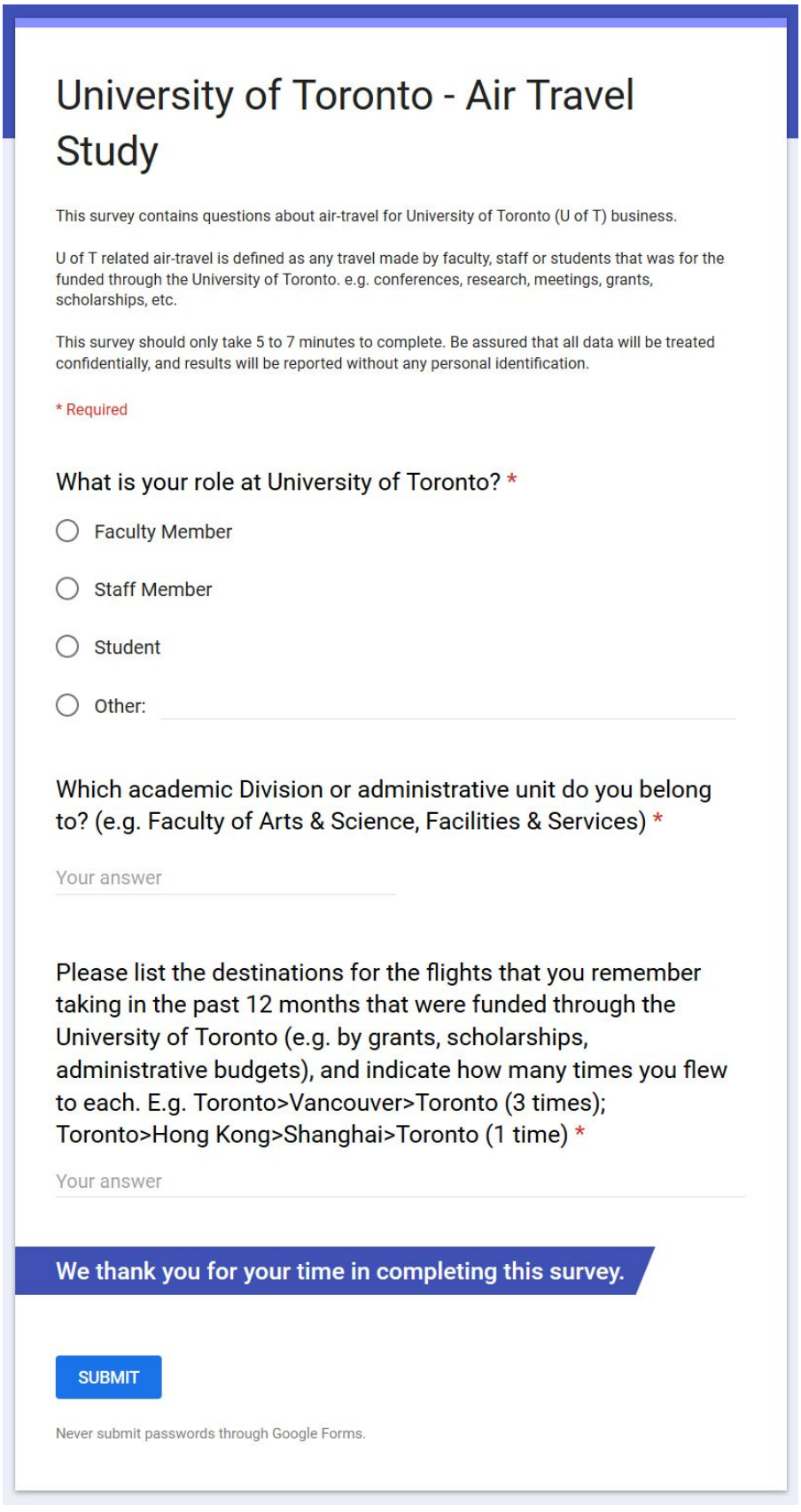
Kwan, L. C. (2008). *Quantifying the Carbon Footprint of UCLA Related Air Travel*. Unpublished manuscript, University of California Los Angeles.

Protocol, G. G. (2011). Corporate value chain (Scope 3) accounting and reporting standard. *World Resources Institute and World Business Council for Sustainable Development, Washington, DC*.

VIA Rail Canada (2019). *Plan your trip.* Retrieved from: https://www.viarail.ca/en/plan-your-trip/book-travel/compare-train-and-car

Wynes, Seth & Donner, Simon. (2018). Addressing Greenhouse Gas Emissions from Business-Related Air Travel at Public Institutions: A Case Study of the University of British Columbia.

Appendix



University of Toronto - Air Travel Study

This survey contains questions about air-travel for University of Toronto (U of T) business.

U of T related air-travel is defined as any travel made by faculty, staff or students that was for the funded through the University of Toronto. e.g. conferences, research, meetings, grants, scholarships, etc.

This survey should only take 5 to 7 minutes to complete. Be assured that all data will be treated confidentially, and results will be reported without any personal identification.

* Required

What is your role at University of Toronto? *

- ○ Faculty Member
- ○ Staff Member
- ○ Student
- ○ Other: _____

Which academic Division or administrative unit do you belong to? (e.g. Faculty of Arts & Science, Facilities & Services) *

Your answer

Please list the destinations for the flights that you remember taking in the past 12 months that were funded through the University of Toronto (e.g. by grants, scholarships, administrative budgets), and indicate how many times you flew to each. E.g. Toronto>Vancouver>Toronto (3 times); Toronto>Hong Kong>Shanghai>Toronto (1 time) *

Your answer

We thank you for your time in completing this survey.

SUBMIT

Never submit passwords through Google Forms.

Appendix 2: Assigning Institutional Responsibility for Business Air Travel at U of T--Tally of Approaches

	Number	References	University Paid approach: University should account for all Business Travel it pays for including: Students, staff, faculty and guests/visitors	University People: University should account for air travel undertaken by its Students, staff, and faculty (regardless of who pays for it.)	Other approach
Intent	1	Davies J, Dunk R (2016) Flying along the supply chain: accounting for emissions from student air	NA	"HEIs are explicitly providing education for overseas students and study-abroad	NA
	2	Wynes S, Donner S (2018). Addressing Greenhouse Gas Emissions from Business-Related Air Travel at Public Institutions: A Case Study of the University of British Columbia	"Following standard emissions inventory practice, we account only for emissions from business-related air travel purchased through UBC (e.g., billed to the university or to a grant or fund held in a university account). Therefore, flights taken by non-UBC employees but paid for through UBC (e.g., an invited speaker whose travel costs are covered by UBC or a UBC grant) are included. Conversely, flights taken by UBC employees but paid for by an outside institution (e.g., another university paying for a UBC faculty member's travel for a colloquium) are not included, **as they would be counted in the other institution's inventory."**	NA	NA
	3	Flying Less: Reducing Academia's Carbon Footprint--Petition Text (~3000 signatories)	NA	"We petition universities and institutions of higher education: (a) to include all university-related flying (**whether directly paid by the university or by others**) in their environmental impact measurement and goal-setting	NA
	4	"Zero Emissions University" is an initiative for Canadian academics and academic institutions started by faculty at University of British Columbia.	NA	NA	**COMBINATION OF APPROACHES** Open letter to UBC President, Deans and Board to support virtual conferencing, the removal of international presentations (keynotes, lectures, etc) from tenure/promotion criteria and implement policies to reduce long-distance air travel by visitors *to* UBC campus.
	5	Concordia University's Department of Department of Geography, Planning and Environment (GPE) made commitments regarding air travel emissions.	NA	"Each full-time faculty member has agreed to provide her/his work-related flying record, including all individual flight segments, for the period June 1st, 2018 to May 31st 2019" Still developing a strategy, currently in data collection/analyzing period. **No mention of differentiation by 'who' paid for travel.**	NA
	6	"No Fly Climate Sci" a movement started by Peter Kalmus, climate scientist and activist	NA	NA	"We are Earth scientists, academics, and members of the public who either don't fly or who fly less...We hope that our openness about flying less helps to change flying culture...We urge academic institutions to...adopt policies and strategies for flying less." **Does not specify strategy.** More for awareness raising and consientious decision-making around flying.
	7	"We Stay on the Ground" pledge for Flight Free 2020 (~23K signatures)	NA	NA	Social mobilization petition for academia, trying to reach 100 K signatures to mobilize policies and governments. **No strategy specified.**
	8	"Scientists for Future" commitment pledging (~3500 signatures)	NA	NA	"I hereby commit myself with immediate effect to refrain from taking short-haul flights...**I call upon my scientific institution to support** me in climate-friendly travel for business trips by providing the appropriate means and internal regulations." **No strategy specifiec.**
	9	Open letter to Danish Universities calling ambitious climate agenda	NA	NA	**No strategy specified.** Calling for Danish universities to "...implement a series of far-reaching policies."
Action	10	"Sustainable Travel Plan for University of Exeter Campuses 2016-2020" by University of Exeter (2016)	Not explicitly stated but travel plan by university includes reducing **staff** short-haul flights, improving university travel booking to recommend CO2 effective modes of travel, etc. **Targets set based on "University records", presumably financial records**. No mention or focus on academic travel.	NA	NA
	11	"Carbon Footprint as a basis for Research" --Mexico Institute Engineering	NA	"The emissions in this category were estimated based on the air travel associated to **attendance of congresses, workshops, field visits, conferences and courses**. **The travel destinations were provided by the administrative department** and the distances in km per year traveled by each passenger were calculated." Amounted 5% of the institutions air travel.	NA
	12	Lund University Centre for Sustainability Studies (LUCUS) commitments to reduce academic air travel (2019)	NA	NA	**COMBINATION OF TWO APPROACHES** LUCUS commits to "systematically collect travel-related emissions via the university's travel agency and through an individual carbon tracker." Focusing efforts on using data collection as a means to raise-awareness and inspire conscientious actions by their faculty.
	13	University of California, Los Angeles (UCLA)'s case study on the Air Travel Mitigation Fund (2018)	"The carbon mitigation fees apply to all air travel undertaken for university business, with the exceptions of student travel for study abroad programs and student travel on UCLA Athletics charter flights..Grant-funded travel is also excluded..." **Counts only reimbursible travel (i.e, funded by university)**	NA	NA
	14	University of Bergen's Centre for Climate and Energy Transformation (CET) launched a "Low-Carbon Travel Policy" (2018) for their academics	NA	**Far-reaching self-reported policy** at UiB's CET. Includes; evaluating and reducing one's own emissions, reducing footprint of events/conference organized by the CET, and supporting low-carbon research culture by working with peers/other organizations.	NA
	15	University of Basel's 2019-2021 goals for sustainable mobility	One of the goals is "Improving data available on greenhouse gas emissions from business trips" listed as responsibility of Sustainability Office and Finance department. Therefore, **presumably only accounts for university funded travel**.	NA	NA
	16	ETH Zurich's Air Travel Project (2016) tries to reduce staff and faculty air travel.	"In order to measure emissions more accurately, flights of all organisational units are recorded centrally..." **Not specified. Presumably central financial data. No mention of other other strategies to acquire travel data.**	NA	NA
	17	Arizona State University's air travel tax to support the 'Carbon Project'	"...a $10 price on carbon is added to all round-trip ASU-sponsored air travel." **Note: Purpose of this project is to generate additonal funding for campus mitigation projects, rather than to actually address air travel emissions. However, this is the still the chosen method of 'assigning' responsibility.	NA	NA
	18	Arsenault, J., Talbot, J., Boustani, L., Gonzalès, R., & Manaugh, K. (2019). The environmental footprint of academic and student mobility in a large research-oriented university. Environmental Research Letters, 14(9), 095001.	NA	University wide survey on air travel practive over 1 year period. Accounted for faculty travel, reserach staff travel, graduate and undergraduate student travel, international student travel, study abroad student travel and more. Found that altogether, if extrapolated, 60% of UdeM's GHG emissions would be from air travel alone. **Assigns all air travel mobility undertaken by students, staff and faculty as institutional GHG**	NA
	19	"Taking Responsibility for carbon emissions--the evolution of a Carbon Literacy Living Lab" A case study on Manchester Metropolitan University (Dunk, et al 2017)	NA	Establishment of Carbon Literacy Project to mitigate the strtegic mialignment of internationalization agenda of HEI's and their carbon reduction committments. **Assigns student air travel, even if not paid by universtiy, as responsibility.**	NA
	20	Grant, N., Salvi, P., Thomas, C., Warwick, L., Schoenrock, E., Robertson, S., ... & Olympios, A. (2019). Aviation Emissions at Imperial College, London: Current Status and Policy Recommendations.	NA	NA	Used Approach 1 to identify air travel emissions. Concluded by saying 'higher data coverage' should be strived for, actions to mitigate air travel emissions need not be dampened by lack of full data. Naescent initiative, cannot be classified at Approach 1 or 2 yet.

This document has reviewed resources from the Virtual Conferencing Literature compilation along with additional resources to identify:
a) calls for action (intent expressed via petitions, letters, etc) and
b) applied approaches in the form of pledges, statements, poilicies, etc.

It is important to note that due to a lack of academic discourse on assigning responsibility, a review of intent and actions was undertaken to gather evidence in support of either approaches.

Summary

Geographic Distribution	Sources Reviewed		Total
	Intent	Action	
Europe	2	7	9
North America	3	4	7
South America	NA	NA	NA
Africa	NA	NA	NA
Asia/South East Asia	NA	NA	NA
Pacific Islands/Australia	NA	NA	NA
International (Petitions)	4	NA	4
		Total Sources	20

Geographic Location	Tally of Approaches in Literature		
	University Paid	University People	Other
North America	3	3	1
Europe	3	3	3
International	0	1	3
Total	**6**	**7**	**7**

Appendix 3: Literature on Virtual Conferencing

Literature Compilation for Virtual Conferencing at Universities

Foreword:

The following list of literature has been compiled, in part, from the research undertaken by U of Toronto's Committee on Environment, Climate Change and Sustainability (CECCS) as well as notable contributions by Farzaneh Hemassi (University of Toronto, Faculty of Music), and the Flying Less in Academia: A Resource Guide. This compilation aims to build a case in favor of mitigating academic and institutional air-travel emissions by developing virtual conferencing capacities. It lays out literature and publications that explain *why* virtual conferencing is essential, *who* is working on this issue, *what* has been done and *how* can you (or your institution) enable or host carbon-neutral, virtual conferences. The following literature is by no means exhaustive, rather has been curated for relevance to higher-education institutions.

If you have any literature to add to this list, please email Dione Dias (dione.dias@utoronto.ca).

Why Virtual Conferencing?

Air travel accounts for 5% of global emissions, while, carbon-neutral means of travelling remain far from reality. Virtual conferencing is an alternative to (air) travel, which can effectively mitigate travel-sourced Scope 3 emissions of an institution. Academic and institutional air travel, undertaken by students, staff, faculty and visitors, produces large amounts of carbon emissions which should be accounted for and addressed if an institution hopes to be sustainable.

Andreas Schäfer et al. (2018), "Technological, Economic and Environmental Prospects of All-Electric Aircraft." *Nature Energy*: https://doi.org/10.1038/s41560-018-0294-x.

Attari, S.Z., Krantz, D.H. & Weber, E.U. (2016) "Statements about climate researchers' carbon footprints affect their credibility and the impact of their advice." *Climatic Change* 138: 325. https://doi.org/10.1007/s10584-016-1713-2

Baer, H. A. (2018) "Grappling with flying as a driver to climate change: Strategies for critical scholars seeking to contribute to a socio-ecological revolution." *The Australian Journal of*

Anthropology 29, 298–315
https://doi:10.1111/taja.12291

Balmford et al. (2017), "The environmental footprints of conservationists, economists and medics compared." *Biological Conservation.* https://www.sciencedirect.com/science/article/abs/pii/S000632071730071X?via%3Dihub

Catherine Grant (2018), "Academic flying, climate change, and ethnomusicology: Personal reflections on a professional problem" *Ethnomusicology Forum* https://www.tandfonline.com/doi/full/10.1080/17411912.2018.1503063

Chris Watson, Ed. (2014). *Beyond Flying: Rethinking Air Travel in a Globally Connected World* http://www.greenbooks.co.uk/Book/468/Beyond-Flying.html

Christine Negroni (2016) "How Much of the World's Population Has Flown in an Airplane?" *Air & Space Magazine* https://www.airspacemag.com/daily-planet/how-much-worlds-population-has-flown-airplane-180957719/

Gächter, S., E. Renner (2018) "Leaders as role models and 'belief managers' in social dilemmas." *Journal of Economic Behavior & Organization*, Volume 154, Pages 321-334. https://doi.org/10.1016/j.jebo.2018.08.001

Glover, A., Y. Strengers & T. Lewis (2017) "The unsustainability of academic aeromobility in Australian universities." *Sustainability: Science, Practice and Policy*, 13:1, 1-12, https://doi.org/10.1080/15487733.2017.1388620

Glover, A., Y. Strengers, T. Lewis (2018) "Sustainability and academic air travel in Australian universities." *International Journal of Sustainability in Higher Education*, Vol. 19 Issue: 4, pp.756-772, https://doi.org/10.1108/IJSHE-08-2017-0129

Higham et al (2014), "Climate Change, Discretionary Air Travel, and the "Flyers' Dilemma"" *Journal of Travel Research*: https://journals.sagepub.com/doi/10.1177/0047287513500393

Hopkins, D., J. Higham, C. Orchiston, T. Duncan. (2019) "Practising academic mobilities: Bodies, networks and institutional rhythms." *The Geographical Journal.* 2019: 1– 13. https://doi.org/10.1111/geoj.12301

Joachim Ciers et al. (2019), "Carbon Footprint of Academic Air Travel: A Case Study in Switzerland," *Sustainability* https://doi.org/10.3390/su11010080

Jocelyn Timperley (2019). "Corsia: The UN's Plan to 'Offset' Growth in Aviation Emissions after 2020." *Carbon Brief*: https://www.carbonbrief.org/corsia-un-plan-to-offset-growth-in-aviation-emissions-after-2020.

Jonatah Bosch et al (2016), "Aviation Biofuels: Strategically Important, Technically Achievable, Tough to Deliver." Briefing Paper No 23. London: Imperial College London: https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/BP-23-Aviation-Biofuels.pdf

Nevins, Joseph (2013), "Academic Jet-Setting in a Time of Climate Destabilization: Ecological Privilege and Professional Geographic Travel." *Professional Geographer*. https://www.tandfonline.com/doi/abs/10.1080/00330124.2013.784954

Pidcock & Yeo (2016), "Analysis: Aviation could consume a quarter of 1.5C carbon budget by 2050. *Carbon Brief*: https://www.carbonbrief.org/aviation-consume-quarter-carbon-budget

Seth Wynes et al. (2019), "Academic air travel has a limited influence on professional success," *Journal of Cleaner Production* https://www.sciencedirect.com/science/article/pii/S0959652619311862

Stefan Gössling et al. (2019) "Can we fly less? Evaluating the 'necessity' of air travel," *Journal of Air Transport Management* https://www.sciencedirect.com/science/article/abs/pii/S0969699719303229

Waring et al. (2014), "On the Travel Emissions of Sustainability Science Research." *Sustainability*. https://www.mdpi.com/2071-1050/6/5/2718

Wynes and Nicholas (2019), "Flying Less is Critical to a Safe Climate Future," *Public Administration Review*: https://www.publicadministrationreview.com/2019/07/16/gnd24/

Who is working on this issue?

Academics, some public institutions and professional associations are awakening to the issue and are sharing intent, support or plans to mitigate (air) travel emissions by abstaining from- and using virtual conferencing instead.

'Flying Less: Reducing Academia's Carbon Footprint' is a blog and key resource for updates on all thing air-travel mitigations and virtual conferencing-related. The blog is run by Parke Wilde (Friedman School of Nutrition Science and Policy, Tufts University) and Joseph Nevins (Earth Science & Geography, Vassar College). See also: Frequently Asked Questions for additional resources and rationale.

"Addressing Greenhouse Gas Emissions from Business Related Air Travel…" University of British Columbia Report by Wynes and Donner (2018) Reports on rationale of addressing air travel emissions in universities; reports findings from the faculty survey of air travel and the perceptions-of. Report includes evidence-based recommendations of reducing air-travel emissions at UBC via enabling technology and policy-tools.

"No Fly Climate Sci" a movement started by Peter Kalmus, climate scientist and activist, which has gained the support of many academics, institutions and members of the public.

"Scientists for Future" commitment pledging the avoidance of short-haul flights. The commitment calls on academic institutions to support the pledge by the signatory through appropriate regulations.

"Stay Grounded" is a global network of member organizations which includes 150+ activist organizations, academics, NGOs, organizations supporting communities affected by carbon offset projects and more

"Sustainable Travel Plan for University of Exeter Campuses 2016-2020" by University of Exeter (2016) A mobility plan for the campuses of University of Exeter.

"We Stay on the Ground" pledge for Flight Free 2020. A pledge started by a Swedish organization raising awareness about environmental harms of flying.

"Zero Emissions University" is an initiative for Canadian academics and academic institutions to reinvent the academic culture for a sustainable tomorrow. Started by faculty at Peter Wall Institute for Advanced Studies, University of British Columbia. Includes a pledge for travelling staff or academics to limit their travel-emissions, and an open letter to UBC to implement concrete changes for a cultural shift.

Association for Computing Machinery SIGPLAN's *"Engaging with Climate Change: Possible Steps for SIGPLAN"* (2018) is a report presenting various options of measures reduce conference emissions, largely from travel. Discusses important pros and cons of measures and tries to balance environmental harm with the need to travel.

Concordia University's Department of Department of Geography, Planning and Environment (GPE) made commitments regarding air travel emissions such as disclosing flying activity and emissions, prioritizing virtual conferencing, support grounded travel, and more. (2019)

ETH Zurich's Air Travel Project (2016) tries to reduce staff and faculty air travel. Undertook per capita reduction target of 11% from 2019 to 2025. Interim evaluation report to be released in 2022.

Lund University Centre for Sustainability Studies (LUCUS) commitments to reduce academic air travel (2019)

Open letter to Danish Universities calling ambitious climate agenda (including reducing flying and increasing virtual conferencing support on campus) signed by 650+ academics of various disciplines. The letter has been sent to University management.

Open petition "Call on Universities and Professional Associations to Greatly Reduce Flying" started by Parke Wilde (Friedman School of Nutrition Science and Policy, Tufts University).

Petition to the Council of the American Association of Geographers (AAG) Regarding the CO2 Footprint of Annual Meetings. Calls for AAG to reduce carbon footprint related to their Annual Meeting, as well as transparently collect and publish data on travel emissions.

Petition to the Society for Neuroscience to count and publish the travel footprint of their annual meetings and develop a plan to mitigate emissions.

- *Presentation slide deck by Kimberly Nicholas on Academic Air travel, its impact and recommendations on reducing emissions.*

Tyndall Centre Travel Strategy—towards a culture of low carbon research in the 21st century (2015) View the PDF embedded on the webpage for more details on strategy. One of the tools developed by Tyndall is a decision tree which Tyndall researchers can use before deciding to take up air-travel.

University of Basel's 2019-2021 goals for sustainable mobility put in motion to reduce faculty and student air travel (2019)

University of Bergen's Centre for Climate and Energy Transformation (CET) launched a "Low-Carbon Travel Policy" (2018) for their academics to travel which include several resources that helps their academics be more aware and transparent of their own emissions. They developed a code of conduct, carbon tracker and checklist for low-carbon meetings as resources.

University of British Columbia "*Handbook on Climate Change and Air Travel for UBC Department*" (2019)

University of California, Los Angeles (UCLA)'s case study on the Air Travel Mitigation Fund (Katz and Fortier, 2019) The ATMF is an internal fund generated from university-wide 'tax' per travelling individual, which is reinvested into campus emission reduction projects.

Ecole Polytechnique Fédérale de Lausanne (EPFL's) work on business air travel. Conducted 3 studies to understand the available travel data (and what opportunities exist to reduce emissions), on reasons for business air travel and correlation between air travel and professional/academic success. Found professors to be the most frequent travellers, with travel frequence positively proportional to seniority. Using economy class and opting direct flights over indirect estimated to help achieve 30% emissions reduction.

What has been done?

There are examples of (fully- and semi-) virtual conferences available for inspiration. Most such events produce reports, guidelines and recommendations publicly to aid others attempting the new model conferencing.

'A Clockwork Green: Ecomedia in the Anthropocene' (2018) sponsored by the Association for the Studies of Literature and Environment nearly carbon-neutral symposium hosted completely online

'A Future Without Waste: A Circular Economy Within Reach' (2017) Zero waste conference by the National Zero Waste Council held in Vancouver, live streamed by the City of Toronto for local participation in.

'Reducing Academic Flying' (2019) A symposium on research on action to reduce academic dependence on flying held by the University of Sheffield. The conference hosted 30 local attendees, and global virtual attendees/presenters. Conference materials and presentation recordings available online.

15th International Conference on Music Perception and Cognition and 10th triennial conference of the European Society for the Cognitive Science of Music (2018). This was a distributed, semi-virtual conferences with 4 global nodes. Daily program was presented in the morning and afternoon, to maximize remote virtual participation. All 'hubs' had local keynotes, live streamed to other 'hubs' or available for viewing later. Discussions was also live streamed to encourage global participation virtually.

Case-study article on European Biological Rhythms Society (EBRS)'s nodal virtual conference held in November (Abott, 2019)

'Climate Change: Views from the Humanities' (2016) by The Environmental Humanities Initiative at the University of California Santa Barbara. Conference hosted 50 speakers from 8 countries, all delivering keynotes and presentations virtually for a local (and remote virtual) audience.

Environmental Studies Association of Canada's post-event report from the interdisciplinary roundtable discussion and workshop held to address how to reduce the carbon footprint of academic conferences. (Katz-Rosene et al, 2018)

Reflections from Displacement 2018: conference of the Society of Social Cultural Anthropology (SCA). Detailed reflections of 2018 SCA conference 'Displacement.' Outlines the reach and effect of distributed-nodal conference, challenges faced, feedback received and more. NOTE: U of T is currently working with the organizers to support the hosting of 2020 conference on St. George Campus.

U of Alberta's *'Around the World'* Virtual Conference. Held completely virtually, presenters and attendees participate virtually in discussions on sustainability research.

University of Bergen's Centre for Climate and Energy Transformation (CET) held 'Beyond Oil Conference 2019' using a hybrid model. Explanation of model, technologies used and feedback from the attendees. Interesting idea of "*Low carbon travel fund*" explored, handing out financial aid to attendees opting for low carbon means of travel and may need additional funds to meet the difference in cost from more carbon intensive means.

How can I enable/support/host Virtual Conferencing?

The following section lays out guidelines, post-event reports, reflections and recommendations for virtual conferencing as well as any resources developed.

"A Nearly Carbon-Neutral Conference Model" A White Paper and Practical Guide by Ken Hiltner (2016)

"Reducing the Carbon Footprint of Academic Travel" by Levine et al (2019) *Summarizes ways to reduce air travel emissions from conference attendance.*

Association for Computing Machinery SIGPLAN developed a conference carbon calculator that can estimate single-person carbon emissions as well as conference attendee emissions (using a spreadsheet with attendee data on the origin of travel and destination airport).

Digital set up instructions for attendees and presenters at the Environmental Studies Association of Canada (ESAC) Conference held in Vancouver at UBC in 2019

Europe based website on how to travel by train or ship (to a conference).

Open blog on train-travel resource offering tips on booking grounded routes.

Rae (2019) published a guide for academic societies looking to generate policies addressing air travel emissions. Short document providing guidelines and considerations.

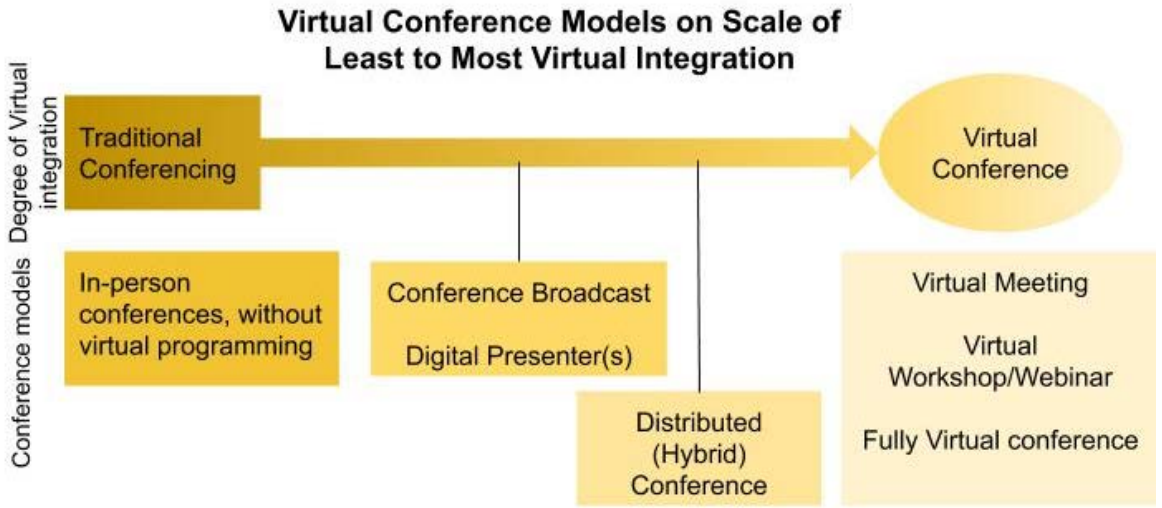
Tips for virtual presenters to better their presentation experience by Dr. Sarah Elaine Eaton

University of Alberta's Toolkit for hosting E-Conferences. Practical guide with experience from hosting Around the World virtual conference.

University of Exeter's Environment and Climate Emergency Working Group White Paper (2019) Review commissioned by Vice Chancellor's Executive Group. See section 4.1-Travel for justification for reducing air travel and proposed measures to achieve that.

Appendix 4: Menu of Options for Virtual Conferencing

Virtual Conferencing Menu-of-Options
This Menu of Options has been developed by the Committee on Environment, Climate Change and Sustainability (CECCS) based on background reserach conducted to support efforts to reduce institutional air travel.
The document outlines a scale of virtual conferencing models for small and large meetings/conferences. These models are not exhaustive, however, are meant to help decide the best option for given type of meeting based on the pros and cons. A running list of softwares and tools are included along with hardware and software needs for each model.



Pros and Cons of Virtual Conferncing Options

Size	Virtual Conferencing	Description	Ideal For	Resources Needed	Pros				Cons			
					Social	Environmental	Engagement	Economic	Social	Environmental	Engagement	Economic
Any	ALL				Improves social equity by making event accessible to those facing social inequities, personal barriers, and other limitations.	Primary environmental benefit of increasing virtual conferencing/meeting is the avoidance of travel emisisons.	Reinforces new and digital methods of engagement and networking--great for trasitioning the academic and business cultures.	In most cases, virtualizing a meeting or conference results in budgetary savings otherwise attributed for travel and accomodation. Who benefits from these savings is dependant on who typically pays for the kind of travel that is avoided through these models.	Partly virtual models of conferencing can disproportionately benefit the physically present participants over their virtual participants. Need for focus on virtual participants in planning of the event.	Increased dependence on Information Communucation Technologies (ICT) increases direct GHG emissions from energy use and embedded carbon in the digital devices. Limited number of studies reviewed argue that presently, the GHG migitation from avoided travel is still larger than the increased emissions from ICT sources.	Can reduce the networking and nonmaterial benefits of in-person conferencing. Need to develop strategies to combat this disadvantage.	Some additional costs from software liscensing, IT staffing, purchase of technologies, and in more extensive cases, investments in infrastructural developments (building or renovating spaces on campus for VC).
Smaller (<100 people)	Virtual Meeting	Several interacting screens sharing audio/video	A meeting e.g. a planning meeting where up to 15-20 people are discussing an idea	Simple video conferencing apps or social media.	Improved equity and accessibility. Accessible to people that may not be able to attend due to other priorities, limitations	Eliminates need for things like one-day travel to attend meeting	All parties engage as they would in physical meetings.	Diminishes need for travel--potential budgetary savings.				Software business license costs + cost of personnel to maintain licenses (if additional staffing is necessary).
	Webinar or Virtual Workshop	Primary presenter(s) delivering content for virtual audience. Can be video recording or live-stream.	For Live: about ~50-70 people	Recording technology, and/or software with Q &A/chat	With video recording, it is possible to amplify reach. By making it available, many more people can participate.	Eliminates need for things like a one-day trip to attend a workshop.	With live-stream, engagement can be made possible through Q&A/discussion board.	Diminishes need for travel--potential budgetary savings.			Presenter may be a lack of audience feed-back or participation unless conscious thought has been put into avoiding	Software business license costs + cost of personnel to maintain licenses (if additional staffing is necessary).
Larger (>100 people)	Conference Broadcast	Virtual broadcasting of usual conference proceeding either by posting recorded videos or live-streaming. Core model remains unchanged, simply sharing the conference to amplify reach. Conference takes place at one location	Possible for all conferences.	Live-streaming can be done on social media platforms. Cameras need to be set up to transmit audio and video.	Amplifies reach. Makes the event more accessible to people that may not be able to attend due to other priorities, limitations or barriers.				Unequal distribution of benefits for physical and virtual particpants. Virtual audience misses out on other benefits of the conference like informal networking or learning opportunities.	No significant carbon mitigation happens in this model, since traditional conferencing persists as usual.	Virtual audience may get sidelined, unless explicitly included through better planning, e.g. acknowledgement of virtual audience, few minutes set aside during Q&A for virtual participants' questions,	Cost of renting/acquiring equipment to live-steam or film event + Cost of hiring photographers/videographers.
	Digital Presenter	Predominantly traditional conference structure with some virtual presenter(s). Core model remains unchanged, addition of only a small virtual component. One location of the conference, with some participation from elsewhere.	Possible for all conferences.	Video conferencing app or technology. A moderator to help facilitate Q & A with live and/or virtual audience.	Enables event to be more diverse, i.e, include more international presenters that may bring new perspectives.	Adding virtual presenter options enables participation without need for travel for that individual.	With a moderator or a live Q&A discussion board, audience may engage with the speaker the same as live speakers.	Potential budgetary savings--especially if conference typically pays for presenter's travel/accomodation.	Having only one or two virtual presenters does not reinforce the urgent need to reconsider travelling for conferences for the attendees.	Since most attendees and speakers still travel to the conference in traditional ways, hardly any carbon is mitigated.	When adding only one or two virtual presentations among traditional-live presenters, pay extra attention to the virtual conferencing experience. Attendees perceive tech failures or discomforts like voice quality more harshly than with the same failures in live-	
	Distributed, Nodal Model of Conference	Local presenter(s) and attendees gather at local node and various nodes around the world are connected virtually. Several locations of the conference, none is considered the central one.	Large conferences that draw in hundreds of people to a venue. Professional and academic societies should consider this option.	A website to host all videos and live streaming on. On-call tech-support to ensure set programming persists across time zones at various nodes and is virtually shared with other nodes	Reinforces the point of innovating academic conferencing. More accessible since more people can attend by taking short distance travel to local node. More accessible for academics from resource-poor states. Promotes more local networking and social cohesion.	Significantly diminishes air travel, thus, a lot of carbon is mitigated.	Promotes local engagement by connecting local actors among themselves. Improves networking.	Diminishes need for travel--budgetary savings in travel and accomodation, and venue and catering.			Consider programming across time zones or else, can result in limited engagement.	Costs associated with hosting content on website = IT personnel, cost of website domain, etc Costs associated with hosting a node = cost of hiring IT personnel to administer programming at set times and for tech support, costs of venue
	Fully Virtual Conference	Hosted completed virtually without a venue. No physical location of the conference.	Possible for all conferences.	Website to host all videos and live-streaming on. Before conference: recording technology to record presentations. Website programming to release videos	Reinforces the point of significanlty innovating academic conferencing.	Takes away all the typical sources of emissions from a conference; travel, food, waste, etc. Only sources are electricity and internet space.		Eliminates need for travel. Budgetary savings from the travel budget can be redistributed to other sustainable causes/initiatives.	Greatly diminishes the social interactions part of conferencing. May negatively affect networking.		While engagement with speaker/presenter is possible, attendees may miss interacting with one another.	Costs associated with hosting content on website = IT personnel, cost of website domain, etc

Technical Requirements for Virtual Conference Models				
Size	**Virtual Conferencing Options**	**Softwares available for Video and Q & A**	**Hardware Needed**	**Soft skills/staff needed**
Smaller (<100 people)	Virtual Meeting	- Skype (for Business) - Zoom (video + chat) - sli.do - ahaslides.com - padlet.com - eventee.co (Event app making tool) - swift.excitem.com - inxpo.com - Big Blue Button	Computer/webcam	N/A
	Webinar or Virtual Workshop		Computer/webcam, mic, projector screen, speakers, etc	N/A
Larger (>100 people)	Conference Broadcast		Camera, mic, social media account for live-streaming	AV staff
	Digital Presenter		Projector screen, speakers, mic, camera (on audience)	AV staff, discussion moderator
	Distributed, Nodal Model of Conference		Projector screen, speakers, mic, camera (on audience)	AV staff, IT services for website support, discussion moderator
	Fully Virtual Conference		Computer, webcam	AV staff, IT services for website support

Methods of Virtual Conference Delivery		
Mode of content Delivery	**Description**	
Live Stream	Proceedings of an event are live-streamed for virtual participants or attendees.	
Video Stream	Pre-recorded presentations and panels shared online using one of two modes of delivery	
	TV Broadcast	**Video On Demand (VOD)**
	Videos are broadcasted based on set programming. No user feedback, organizers decide programme.	Videos released and participants can select ones they are interested in. Resolves the conflict of missing presentations due to concurrent sessions.

All virtual programming can be delivered using one of two methods: **Live Stream** or **Video-Stream**.

Within Video-streaming, Organizers can choose between set programming (e.g., a TV broadcast, playlist that proceeds without user feedback) vs. VOD (i.e., users select content they like).

Appendix 5: Air Travel and Scope 3 Emissions at Other Institutions using GHG Reports

Insitution	Year of Data	Total University Population (Students, Staff and Faculty)	Air Travel as % of Total Emissions	Air Travel as % of Scope 3 Emissions	Scope 3 as % of Total Emissions	Total Emissions (in MT eCO2)	Total Scope 3 Emissions (in MT eCO2)	Total Air Travel Emissions (in MT eCO2)	Emissions per Head (student staff faculty) MT eCO2	What is included in Scope 3 emisisons total?	Is Scope 3 emissions added into Total GHG emissions?
University of Saskatchewan	2015	22,682.20	8.41%	74.77%	11.25%	173,600.0	19,531.0	14,603.0	7.653578577	Air Travel, solid waste and 'other' travel	Yes
University of Manitoba	2016	41,018.00	16.82%	42.64%	39.44%	59,790.0	23,579.0	10,055.0	1.457652738	Commuting, shuttle services, business-related travel (all modes paid for-), solid waste and paper bought	Yes
McGill University	2017	42,997.00	14.71%	49.21%	29.90%	56,004.0	16,746.0	8,240.0	1.302509477	• Electricity, natural gas and heating oil consumption • Student, faculty and staff commuting • Directly-financed University-related airtravel • Travel by the University's sport teams • Travel by the Macdonald Shuttle bus • Water supply & treatment • Powertransmission & distribution (T&D) losses occurring between the production sites and McGill facilities	Yes
University of British Columbia	2017	179,689.00	14.51%	22.27%	65.16%	115,035.3	74,958.0	16,693.0	0.640191108	Paper, Staff/Faculty air travel, commuting, buidling lifecycle emissions (!! Only Paper required to be offset with Scope 1 and 2 Emissions. Other sources reported but not offset!)	Yes
University of Toronto	2009	112,918.00	35.43%	233.51%	16.00%	163,231.0	24,769.0	57,838.0	1.445571122	Financed- travel (subtracted from Scope 3 total here to avoid double counting), faculty/student/staff commuting and solid waste disposal	Yes, except air travel emissions.

Canadian Higher Education Population					
Institution	**Year of Data**	**Student**	**Staff**	**Faculty**	**Total University Population**
University of Saskatchewan	2010	18,696.0	2,794.7	1,191.5	**22,682.2**
Notes		Undegradudate and Graduate only, other categories subtracted.	Derived from "non academic full-time equivalent staff".	Derived from "academic full-time equivalent staff".	
University of Manitoba	2019	30,319.0	10,699.0		**41,018.0**
Notes		Undegradudate and Graduate only.	Staff and Faculty not differentiated.		
McGill University	2019	37,833.0	3,457.0	1,707.0	**42,997.0**
Notes		Undegradudate and Graduate only, other categories subtracted.	Taken from wikipedia, which derived number from 2008 Factbook (could not be found online).		
University of British Columbia	2018-2019	64,798.0	108,834.0	6,057.0	**179,689.0**
Notes		Undegradudate and Graduate only.			
University of Toronto	2019	91,286.0	7,198.0	14,434.0	**112,918.0**
Notes		Undegradudate and Graduate only.		Only active faculty with teaching/research appointment, not Fellows or TA's.	