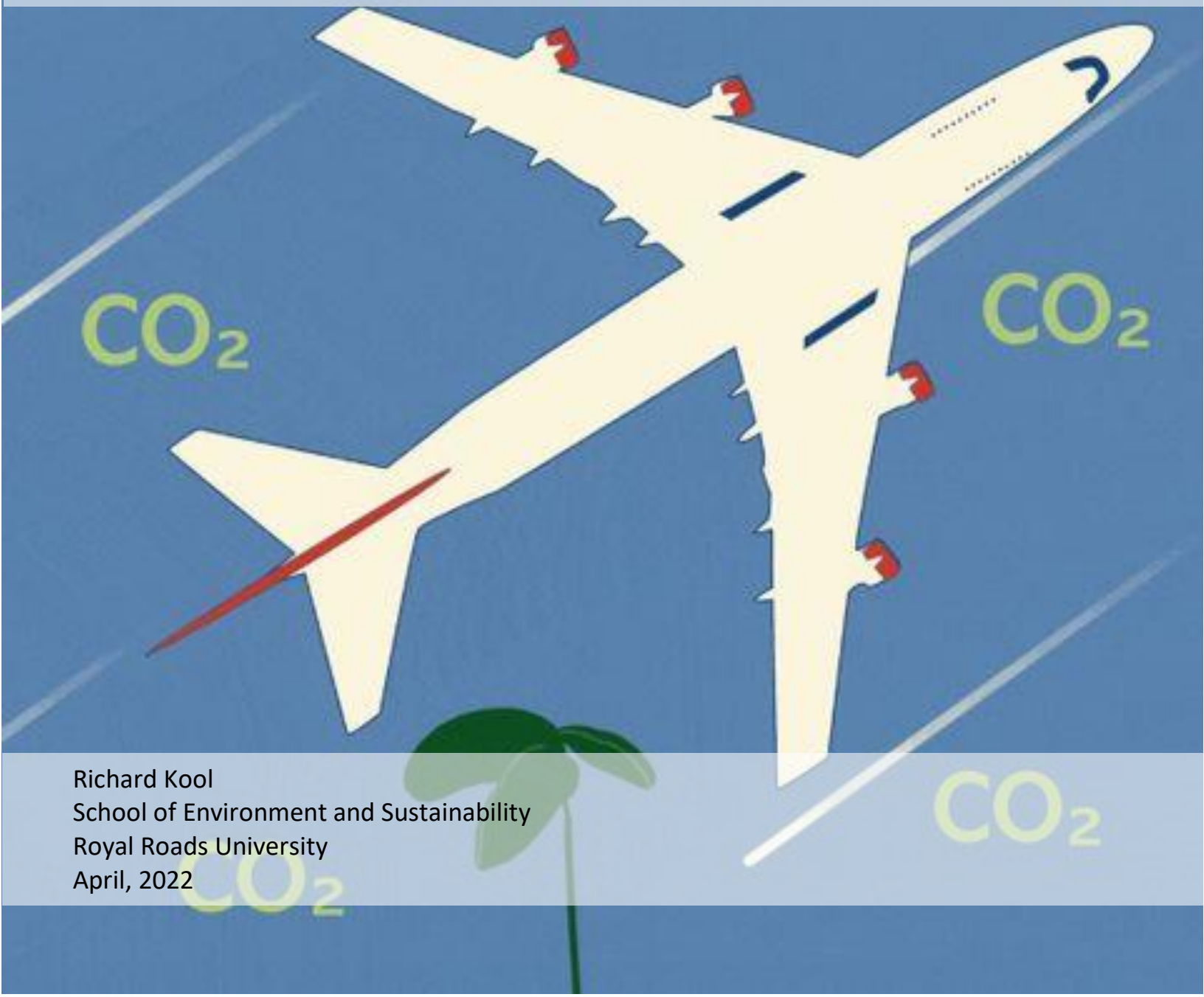
Scope 3 Emissions at Royal Roads University: Greenhouse Gas Emissions due to Business-related Air Travel in 2019



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Full Disclosure: Richard Kool's 2019 RRU business-related air travel emissions were 0.6093 tCO_2e; this represents 0.05% of the total business-related air travel for RRU for 2019.

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Summary

- For 2019, RRU employees, in total, travelled more than ≈ 4.2 million kilometres (roughly 100 trips around the Earth at the equator) on business-related air travel, which resulted in more than 1200 tCO_2e[1] of emissions, or roughly 2 tCO_2e for every employee
- Business-related air travel generates roughly half of the total GHG emissions attributable to the university
- Twelve employees (five executive and seven faculty, which represent 2% of RRU staff) generate 25% of all the business-related air travel emissions, and 13% of the university's total GHG emissions

Introduction

In this time of climate emergency, global academic organizations and institutions are trying to quantify and reduce their contributions to global greenhouse gas (GHG) emissions. These institutions consider three kinds of emissions:

- Scope 1 emissions: "direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by an organization (e.g., emissions associated with fuel combustion in boilers, furnaces, vehicles)".
- Scope 2 emissions: "indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling" (*Scope 1 and 2 Inventory Guidance*, n.d.).
- Scope 3 emissions: "…the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value chain" (*Scope 3 Inventory Guidance: Description of Scope 3 Emissions*, n.d.)

My report focuses on the Scope 3 emissions associated with business-related air travel at Royal Roads University in 2019, the pre-pandemic year that can be considered a baseline for future measurements.

Academics fly. Significant scope 3 emissions are associated with faculty members attending scholarly conferences and to carry out research and other collaborative projects. Recently, for example, Klöwer et al. (2020) examined the GHG emissions of attendees to the 2019 American Geophysical Union's (AGU) annual conference in San Francisco. Shockingly, they reported that:

> We calculate that its 28,000 delegates travelled 285 million kilometres there and back — almost twice the distance between Earth and the Sun. In doing so, they emitted the equivalent of about 80,000 tonnes of CO_2 (tCO_2e). This is about 3 tonnes per scientist, or the average weekly emissions of the city of Edinburgh, UK.

Similar kinds of analysis have been done for other major conferences and the end results are the same; large academic conferences have an enormous air travel-related GHG 'footprint'.

There are multiple analyses of academic institutions and their research-related GHG emissions. A small recent sample includes:

- Ciers et al. (2018) examined emissions by researchers (including graduate students) from the École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland from 2014 to 2016. Their findings indicated that research-related air travel "is responsible for about one third of EPFL's

[1] tCO_2e stands for metric tonnes (t) of carbon dioxide (CO_2) equivalent. "Carbon dioxide equivalent" is a standard unit for counting greenhouse gas (GHG) emissions regardless of whether they're from carbon dioxide or another gas, such as methane. (https://www.climateneutral.org/faq)

total CO_2 emissions".

- A new edited book (Bjorkdahl & Duharte, 2022a) examines the issue of academic work and air travel, hoping to "shine a light on how and why academic work became so entwined with air travel, and what can be done to change this flying habit" (p. 2).
- Research-related air travel at the Université de Montréal "...are responsible for nearly 40 per cent of all the university's CO_2 emissions" (Talbot & Arsenault, 2019).

More broadly examining the GHGs for an entire institution, researchers of the University of Oxford wrote:

> The absolute size of the university's greenhouse-gas footprint is astonishingly large — comparable to that of the eastern Caribbean island nation of Saint Lucia. It is two orders of magnitude smaller than Microsoft's greenhouse-gas footprint, but one order of magnitude larger than that of the London Stock Exchange, according to estimates publicly disclosed by those organizations (Bull et al., 2022).

Closer to home, Wynes and Donner (2018) explored the GHG emissions due to all "business-related air travel and associated emissions" at the Vancouver campus of the University of British Columbia. They reported, for January 2015 to June 2016, that "... business-related air travel emissions at UBC total 26,333- 31,685 tCO_2e each year, equivalent to 63%-73% of the total annual emissions from the operation of the UBC campus."

Early in 2020 I proposed doing a GHG examination of Royal Roads University's broadly-defined business-related air travel emissions. However, the COVID pandemic intervened, and it wasn't until February 2022 that the data became available.

A novel part of my assessment is that rather than looking only at scholarship-related air travel, I was able to develop a picture of the carbon emissions generated by the entire university community, including that of both executive and marketing-related travel.

Methods

Rather than trying to examine more than 800 individual claims for business-related air travel in 2019, I used an Excel-based 'trip log' kindly supplied by the RRU Finance Department. This log included the departure and return dates and cost centre codes that identified the particular purpose of the trip and which organizational unit, or even which individual, was responsible for the trip[2]. The log also, most often, indicated the trip's purpose and its destination, including multiple destinations if relevant. A list of cost centre codes allowed the allocation of emissions to particular facets of RRU's enterprise, i.e. executive, marketing, research, conference attendance etc.

Without examining actual travel records, I may not always have accurately categorized individual trips, nor known exactly where trips were going if all that was provided was a country name. I would also have missed additional legs as part of a long trip if those legs weren't mentioned. For short trips such as those to Vancouver and the lower mainland, I may not have been able to tell which involved air travel (nor if seaplane or helicopter were used) and which used the ferry (see Assumptions section below). No data was collected for personal vehicle or bus transportation. Nonetheless, I believe that the data I was provided gives more than enough information for this first approximation of RRU Scope 3 business-related air travel.

Wynes and Donner at UBC generously provided me with the most current version of their

[2] all data are presented in this report without individual attribution

spreadsheet (2018). Data from the Finance-provided trip log was gleaned and put into the UBC spreadsheet.

Assumptions

- Round trip travel between Victoria and Vancouver occurring on the same day and costing more than $300 is assumed to be air travel from airport to airport. No flights were designated to be by commercial helicopter or float plane (two common means of travel between downtown Victoria and downtown Vancouver).
- Travel within Canada and North America was routed through the most parsimonious Air Canada connections when possible. If there were non-stop flights from Victoria to the destination as well as flights via Vancouver, I chose the outbound trip to be non-stop and the return to be routed through Vancouver.
- Overseas travel was routed to destinations via Air Canada's website when possible. If Air Canada did not give a routing, Google Travel was used, and I chose the shortest time (and not the lowest cost) for travel as the routing.
- When travel only mentioned countries (e.g. Nepal, Pakistan and India), I assumed capital cities were the destinations and created routing to and from those cities. In the absence of any information about inter-country travel, I assumed none.
- Cost centre codes were used to identify which administrative unit/subunit was responsible for trips and associated emissions.
- Conference travel associated with cost centre codes related to the marketing department were coded as marketing and not as conference travel. I tried to keep the conference travel category focused on academic or professional meetings.
- I included RRU-related flights that were paid for by other organizations. Travel related to RRUFA, but paid for by CAUT or CUPE for example, or travel related to granting agency reviews and paid for by those agencies, if they were recorded as part of the RRU trip log, were also included in this data set. In the future, those costs would likely be assigned to the organization paying for them and might be accounted for in their Scope 3 emission reporting and not as RRU emissions.
- The UBC spreadsheet used in this analysis is sensitive to the emissions associated with short, medium and long-haul trips, as well as to the tickets' seat class. Short haul trips generate more emissions per kilometre travelled than long haul flights do as there is a significant difference in emissions between those generated at take-off versus those resulting from cruising at altitude. Higher ticket classes offer more space per person and results in higher per capita emissions.
- All travel legs which involve more than eight hours per leg were classified as business-class travel as per RRU Travel Policy; all travel less than eight hours was coded as economy. However, I have no information as to whether there were <eight hour flights where economy-plus or business class tickets were purchased, nor if any of the long-haul flights >eight hours were done in economy or economy plus class. Table 1 presents the values used to calculate emissions from the various classes of travel.

This is a first approximation of RRU's Scope 3 business-related air travel emissions.

Table 1: Emission factors for business-related air travel (kg CO_2e/passenger km), from Wynes & Donner 2018

Class	Long Haul >3700 km.	Medium Haul 463-3700 km	Short Haul <463 km
Economy	0.14678	0.16508	0.27867
Economy plus	0.23484		
Business	0.42565		
First	0.58711	0.24761	

"... the required[carbon] footprint reductions in the case of developed countries are at least 47% in nutrition, 68% in housing, and 72% in mobility [car use and air travel] by 2030 and over 75% in nutrition, 93% in housing, and 96% in mobility by 2050" (Institute for Global Environmental Strategies, 2019, p. v).

"The cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all. (very high confidence)" (IPCC (Intergovernmental Panel on Climate Change), 2022, p. 35)

Results

For 2019, RRU employees, in total, travelled more than an estimated 4.2 million kilometres (roughly 100 trips around the Earth at the equator) on business-related air travel, which resulted in more than 1200 tCO_2e of emissions, or roughly 2 tCO_2e for every employee.

What is the fraction of RRU's emissions due to business-related air travel?

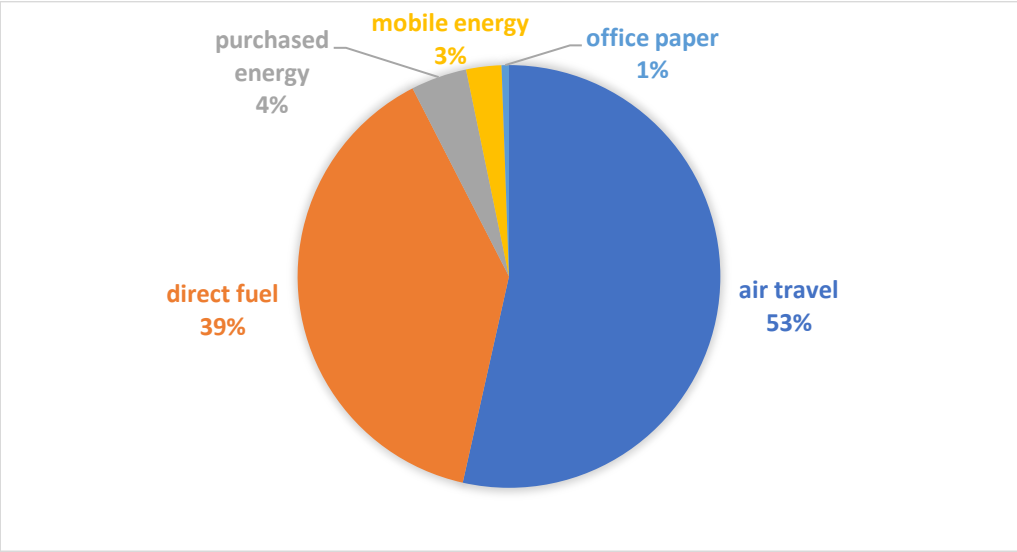
Recognizing the assumptions as listed above and given the quality of the data available, business-related air travel accounts for roughly half of RRU's total GHG emissions (see Figure 1).

While this is a significant fraction of the University's emissions, it is less than the values reported by Wynes and Donner (2018, p. 4), who note "63%-73% of the total annual emissions from the operation of the UBC [Vancouver] campus" are due to business-related air travel.

UBC, as a research-intensive institution with a complement of faculty engaged in globally-focused scholarship, may simply have a lot more people travelling much greater distances for their research-related work than are at RRU, which is not as research-intensive.

With roughly 16,000 employees, the UBC per capita air travel emissions were around 1.7 tCO_2e, while at RRU, with roughly 600 employees, emissions were slightly higher, around 2 tCO_2e/capita.

Figure 1. Percent of Total RRU GHG Emissions for 2019, by Source



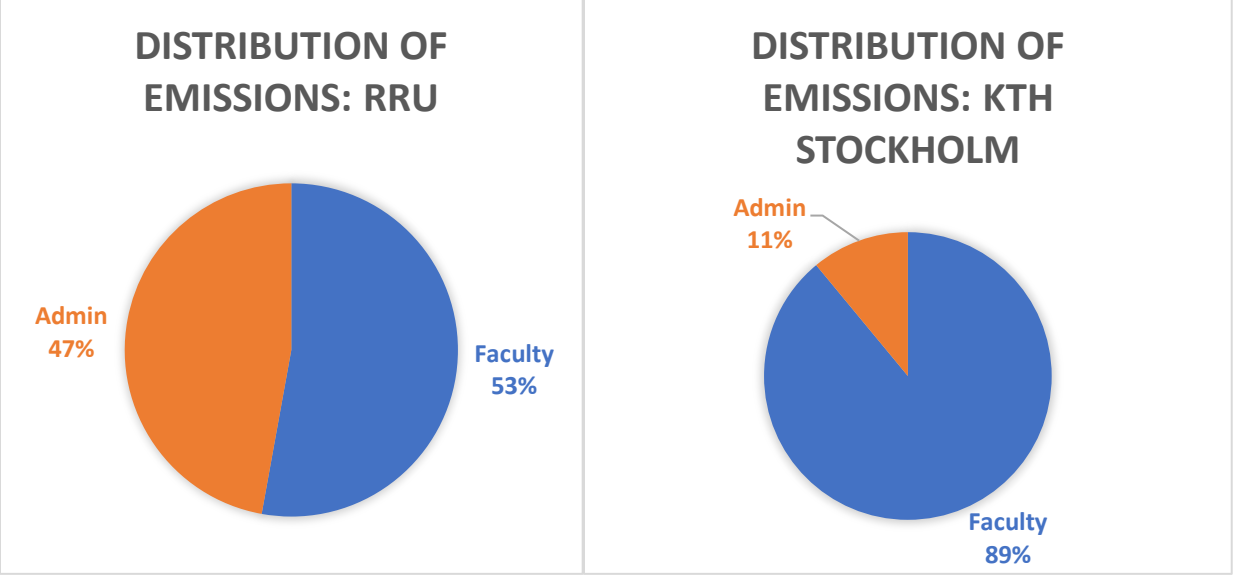
Who generates the emissions?

A recent analysis by Pargman et al. (2022) of the 2019 calendar year at the KTH Royal Institute of Technology in Stockholm provided a case that allows a comparison of a general distribution of air travel-related emissions based on two broad categories, *administration* and *faculty* (p. 144). Whereas at KTH, "faculty" contributed nearly 90% of all emissions, at RRU, "faculty"-related emissions were significantly less at just above 50% (see Figure 2 & 3). The difference here is likely similar to the reason for the difference

between RRU and UBC; KTH is a research-intensive institution with faculty travelling broadly for a variety of research-related reasons.

However, as will be made clear in subsequent sections, a considerable fraction of the RRU emissions seem to be connected to marketing, recruitment and related matters. While I don't have any data to make comparisons, I wonder if UBC or KTH, or indeed any other Canadian university, generates as many emissions due to institutional marketing when compared to their total emissions.

Figure 2: A Comparison of RRU's and KTH Stockholm's Air Travel-related Emissions



How do RRU's different business activities relate to our Scope 3 emissions?

It is not at all surprising that faculty-related air travel-- which can involve both attendance at academic conferences and travel to do research or engage in collaborations-- is the largest component of any university's Scope 3 emissions. However, what I found surprising about the RRU data was the scale of travel and emissions due to various aspects of RRU's marketing and recruitment activity (see Figure 3). If we consider that a great deal of Executive travel is also related to initiating and building relationships that can lead to new business opportunities, we could add a significant amount of travel from that domain into the marketing and advancement column, resulting in an even greater percentage of RRUs emissions related to marketing. Indeed, in that case marketing and the academic functions' emissions are almost the same.

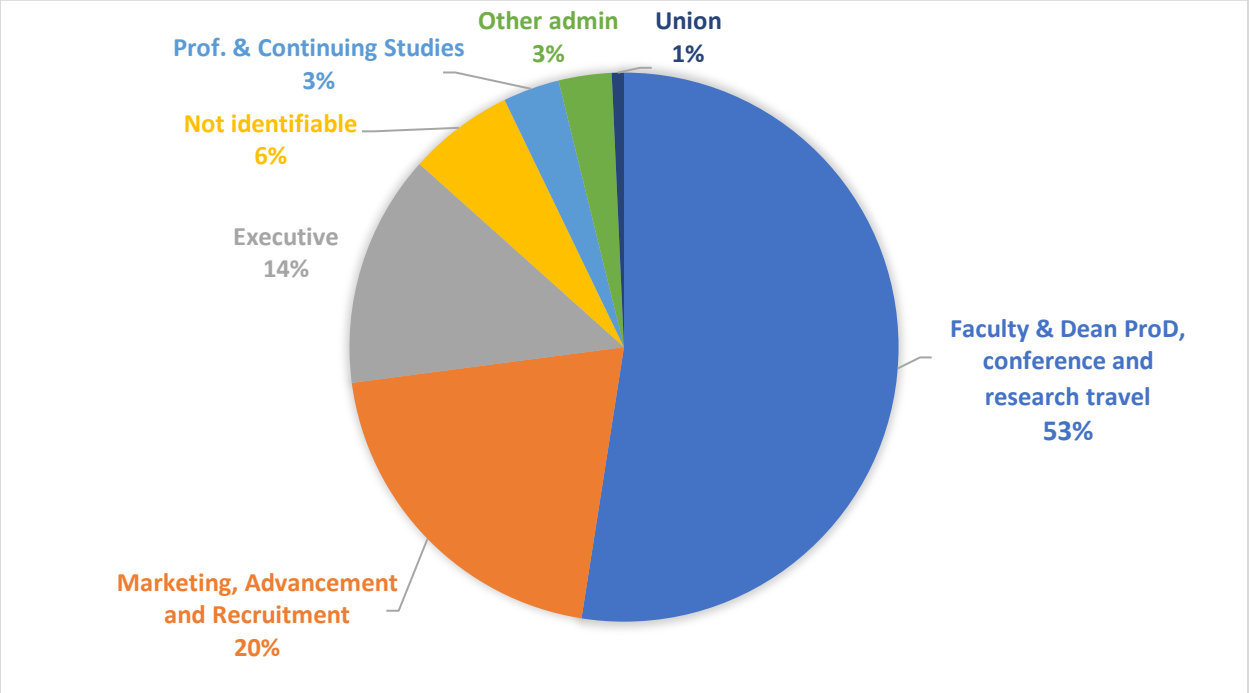
Conference travel is the single largest reason for travel at RRU (see Figure 4). We're not unique in this: for example, "…more than half of all work-related air travel by the academic staff [of Aalborg University] within a year had conference attendance as its main purpose"(Lassen, 2022, p. 283).

While it is not surprising that academic conference travel is the largest travel-related source of GHG emissions at many universities including RRU, it is also the one area of academic travel that has had the most attention over the past years (e.g., Klöwer et al., 2020; Kreil, 2021; Talbot & Arsenault, 2019). A number of academic organizations are

moving from annual to biannual face-to-face meetings, and offering hybrid models where attendees can either convene face-to-face or via technological means. These innovations could reduce the number of conferences faculty and marketing staff attend and could be one significant means of reducing our GHG emissions.

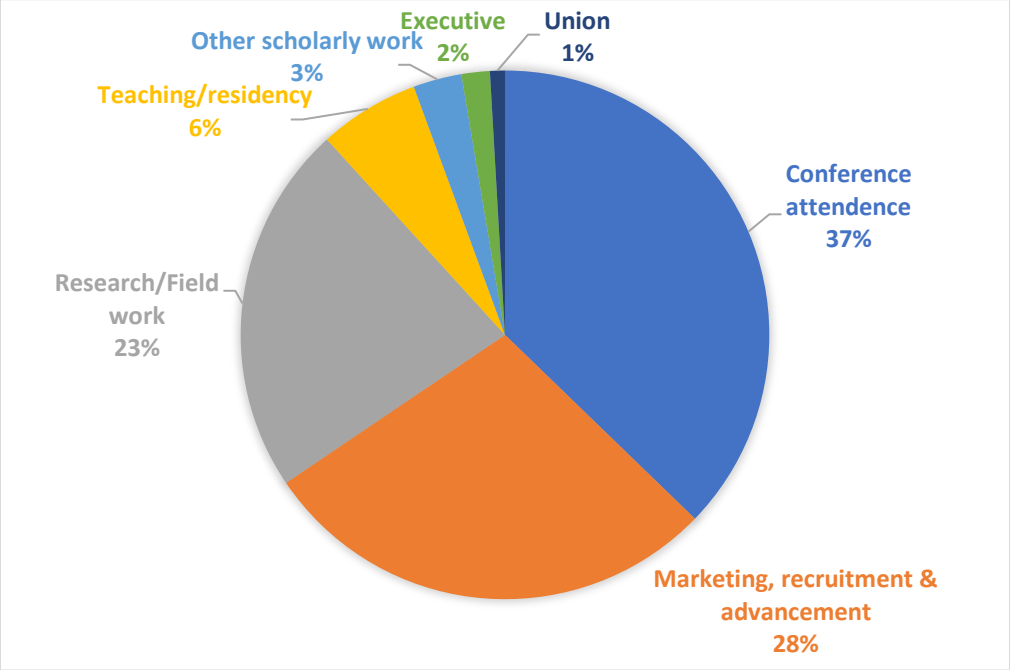
The difference between the 14% of emissions allocated to Executive in Figure 3 and the 2% of Executive in Figure 4 reflects the fact that many of the trips taken by the Executive are related to marketing, and they are coded as such. That is, the data indicates that the Marketing, Advancement and Recruiting staff generate about 20% of the emissions, (Figure 3), but Executive travel related to this purpose adds another ≈8% (Figure 4).

Figure 3: Scope 3 Emissions by Institutional Domain



...based on our review of the emission scenarios, this study proposes we need to aim for lifestyle carbon footprints targets of 2.5 (tCO_2e) in 2030, 1.4 by 2040, and 0.7 by 2050. These targets are in line with the 1.5 °C aspirational target of the Paris Agreement and for global peaking of GHG emissions as soon as possible without relying on the extensive use of negative emission technologies (Institute for Global Environmental Strategies, 2019, p. v).

Figure 4: Scope 3 Emissions by Purpose of Travel



What would be the impact of changing from business class to economy-plus or economy class?

The UBC spreadsheet used in my analysis is sensitive to the emissions associated with short, medium and long-haul trips, as well as to the class of tickets. Short haul trips generate more emissions per kilometre travelled than long haul, but that difference is relatively small compared to the difference in emissions due to moving "up" in seat class (see Table 1).

If all 2019 air travel had been done in economy class seating, total emissions would be reduced from ≈1200 tCO_2e to 740 tCO_2e; this is a very significant reduction of nearly 40% that could be done in a single year of *status quo* air travel. The single act of shifting all air travel to economy class could bring RRU, in one year, to where we need to be in *2026* in terms of reaching our goal of 50% air travel-related GHG reductions by 2030 from our 2019 baseline. Even changing all business class seats to economy-plus class would have resulted in a reduction to 860 tCO_2e in 2019.

Who are creating emissions?

The distribution of emissions created by business-related air travel is not evenly distributed across academic or administrative units; some employees travel a lot while others travel very little if at all. Nonetheless, if each faculty member were allocated an equal share of the faculty travel (≈6.5 tCO_2e/capita from the 2019 baseline), each would get to generate slightly fewer emissions than a round trip flight from Victoria to London UK; and as noted, dividing the total emissions by all staff, would have given each employee around 2 tCO_2e in 2019 (equal to around two round trips to Toronto).

Given the dataset I worked with, it was not possible to identify individual faculty members and their relationship to travel other than through unique research-related project codes. Internal professional development, academic administrative stipends and small research grant funding could not be

individually assigned. However, when looking at total emissions assigned to particular funded research codes, it appears that seven individuals (9% of total RRUFA membership) contribute ≈20% of the total faculty/librarian emissions (140 of 638 tCO_2e). This is not exceptional; productive faculty are in demand to speak at conferences and often engage in collaborations which are national or international in scope. As noted earlier, air travel has become a central feature of academic life.

However, when compared with the total Scope 3 air travel-related emissions (≈1200 tCO_2e):

- those seven faculty members are responsible for ≈11% of the total emissions;
- five members of the RRU Executive are responsible for ≈14% of total emissions;
- these 12 people (2% of total RRU employees) result in ≈25% of air travel emissions and ≈13% of the total GHG emissions of the entire university;
- 50% of the total distance flown was generated by 14% of the flights.

As noted in the introduction, the IGES (2019) report refers to the need for a global lifestyle carbon footprint of 2.5 tCO_2e/capita by 2030 to stay within the 1.5° C temperature window. For the highest emitters at RRU, which to the best of my ability to determine from the information provided, are members of the Executive, this would amount to a ≈95-97% reduction in carbon emissions by 2030 if their business-related air travel was the **only** source of lifestyle GHG emissions. The top-flying faculty members would have to reduce their travel emissions between 90-95% through the same time period.

Discussion

If the RRU community is going to "confront climate change with courage and action" (Royal Roads University, 2022), the analysis presented in this report lays out a clear need for both attributes; as an institution, we will need courage to take the action that is within our power to make a contribution to the global effort to reduce GHG emissions. I hope that the actions we will take and the leadership we can show will inspire others, inasmuch as we have been inspired by the actions and leadership of other institutions.

We need to follow the "carbon law"

Action on air travel-related emissions is critical to moving towards achieving the RRU Climate Action Plan Action 1.1: "To extend institutional responsibility and leadership to reduce scope 3 emissions 50% by 2030 (from 2019 levels) and to offset the remainder."

Our immediate actions should be based on the work of the Stockholm Resilience Centre, which indicates that to meet the Paris climate change goals and have "a 50% chance of limiting warming to 1.5° C by 2100" (Rockström et al., 2017, p. 1269), we need to adopt a "carbon law of halving gross anthropogenic carbon-dioxide emissions every decade" to 2050. This carbon law "is an exponential trajectory inspired by Moore's Law in computing, where computing power doubles and costs halve every few years" (Gaffney et al., 2019, p. 22).

Committing to the carbon law reductions is a goal Royal Roads University should commit to and work towards. Our obligation, then, is that RRU has to reduce our air travel emissions by about 7% a year, every year from 2020-2050 (see Figure 5).Following this yearly targeting would reduce our air travel GHG emissions by 50% by 2030.

Who gets to fly? A new policy framework

To make the necessary GHG reductions, difficult decisions will need to be made around who gets to generate emissions, and how much they get to generate. While air travel during

the first two years of the COVID pandemic essentially went to zero, there is no doubt that we are going to see a significant increase in flying, and thus RRU-related GHG emissions, in 2022 and onward.

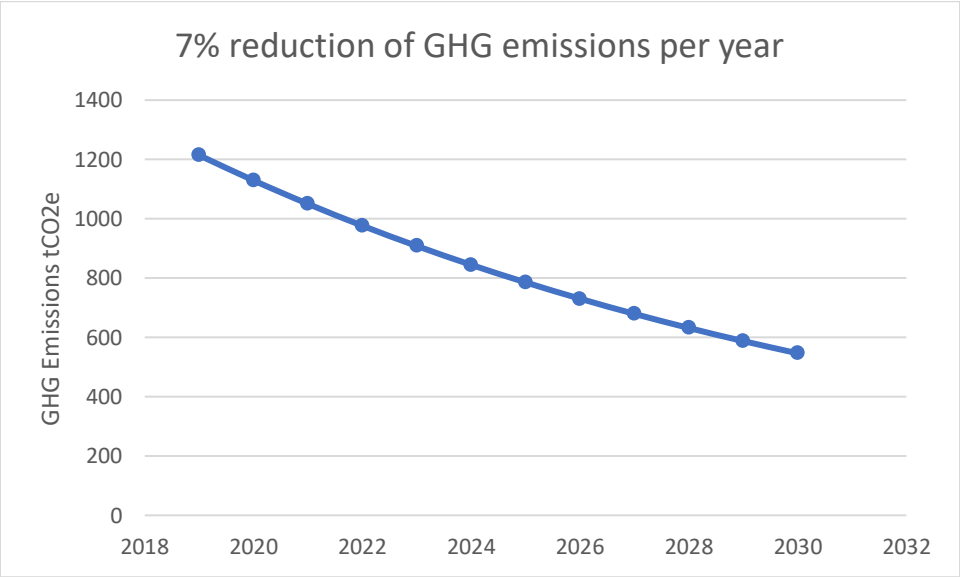
- Would the RRU Executive be prepared to ensure that their GHG expenditures for 2022 not exceed their carbon law limit based on the 2019 baseline (going from 166 tCO_2e in 2019 to 134 tCO_2e in 2022, a ≈20% decrease in air travel emissions)?
- Can faculty decide collectively how they should go from 446 tCO_2e to 359 tCO_2e?
- Should our marketing efforts be generating ≈20% of RRU's air travel-related GHG emissions (which excludes Executive travel that is directly related to marketing RRU programs and collaboration)?

There are many reasons for air travel beyond simply the purpose as indicated on a travel authorization document. Travel allows RRU employees a chance to see interesting parts of the world and have personally enriching experiences. Intense international marketing and relationship-building is clearly an important part of the University's long-term financial health. And for many academics, there is a fear that not being able to travel to do research or attend conferences could be career-limiting:

> "Because 'plane travel is perceived as a key driver for career progression'..., academics are disinclined to drop their flying habit, even as they grow ever more aware that this habit is contributing to global warming... the idea that flying is necessary if one is to have an academic career has become ever more entrenched and appears now an almost inseparable part of what it means to be an academic" (Bjorkdahl & Duharte, 2022b, p. 7).

If we are going to meet the targets and commitments laid out in the RRU *Climate Action Plan* and embrace regenerative sustainability, our community is going to have to look carefully and critically at our use of air travel; reductions in the use of air travel are going to have to be on-going and significant starting this year and in the years to come.

Figure 5: Business-related air travel emission targets for a 7% reduction per year from 2019 to 2030



The Tyndall Centre for Climate Change Research in the UK has asked its members the question of who should get to fly, or more generally, who should be allowed large GHG emissions in the course of their work (Le Quéré et al., 2015). Tyndall Centre researchers have access to national rail systems both in the UK and once they cross into Europe where distances are all relatively short (e.g., from London to Rome on the train is about 1000 miles; the same distance from Vancouver to Regina SK) and their scheme does take alternatives to flying into account. RRU staff are located on an island with no rail transport, and even once we cross over to North America, effective rail links both eastward and southward are very expensive, not particularly efficient and not always very reliable (Katz-Rosene, 2020). With North American distances between population centres larger than in Europe or the UK, the time to travel is also much greater.

The Tyndall metric for decision making, while not totally applicable to the RRU context, considers two important variables: stage of academic career (Table 3), and justification for travel (Table 2).

Table 2: Travel Justification Weightings (from Le Quéré et al., 2015)

Weight	Justification
1	Well justified emissions, for example: Conduct field work. Travel informs directly policy on climate change and global sustainability (e.g. IPCC). Travelling to meet contractual engagement (e.g. from research grants), with no alternative options available. Risk of job loss with refusal to travel. And for Stage 1: Present and promote own research. Establish contacts. Attend and present work at project meetings.
2	Useful but with potential for using alternative options. Stage 1: Attend a workshop not directly related to own research. Stage 2: Travel to present own work and promote own research. Stage 3: Travel to explore new topics. Could lead to important research or funding for own or group/institute research. Travel acts to move projects or significant collaborations forward
3	Less well justified with much potential for using alternative options. Good value mainly for low-emissions travel. Stage 3: Travel to present own work and promote own research. Travel to establish or maintain own collaborations. Invited guest lectures.
4	Poorly justified emissions. Good value only for low-emissions travel. Travel to keep up to date or renew connections with colleagues. No results presented. Little pre-travel arrangements made to optimize the usefulness of the meeting.

Table 3: Research Stages (from Le Quéré et al., 2015)

Stage 1	Early Stage Researchers (for example up to 2 years after PhD)
Stage 2	Intermediate Stage Researchers (for example, up to about 10 years after PhD)
Stage 3	Established Researchers (for example, in permanent positions with over 10 years since PhD)

While this rubric was designed for decision-making around academic travel, there is no reason why something like this couldn't be applied to non-academic travel such as that of marketing, recruitment and advancement whether carried out by RRU staff or Executive.

Recommendations

1. Commit to the "carbon law" reductions

We should be focused on achieving no more than 976 tCO_2e generated through air travel for 2022, with each administrative domain at RRU considering how they will do their part to ensure this happens. One relatively simple action would be, other than just flying less, maintaining all travel in economy class with economy-plus for extended long-haul flights. Another action could be to change policies around travel to those that would encourage employees who must travel to use the lowest GHG emission-mode of travel, acknowledging that that travel might take more time or even cost more.

2. Allocate fair GHG emissions credits to academic and administrative units

Based on the 2019 data presented in this report, we now have an understanding as to how air travel has been undertaken at RRU and now have a baseline from which we calculate emission reductions in business-related air travel. A cross-institutional working group could devise and develop a fair system for allocating GHG emissions credits to various units based on the data presented here as well as decisions on how GHG emissions should be allocated across the institution.

3. Develop appropriate rubrics for air travel justification

If we are going to meet our commitments, then there must be some prioritization of travel across and within the different administrative and academic domains. It would seem appropriate that each domain engages in the discussion about how they would justify air travel, with rubrics that should serve the purpose of reducing Scope 3 GHG emissions for the near future. The Tyndall Centre model already mentioned is one; Kreil (2020) also presents an extensive list of potential measures that can be taken to reduce academic air travel (see Appendix 1).

4. Ensure we can capture necessary information from business-related travel

The only way we will know if we are meeting our goals is by ensuring a credible and easy-to-use system is in place to capture air travel-related emissions. The easiest way may simply be to ensure the travel expense spreadsheets also ask for all airport codes for the entire round trip's air travel.

5. Link internal grants to GHGs and not only to money

Competition for the internal granting process at present is based on a maximum dollar value

per grant. However, I imagine that much of that money goes towards air travel to conference attendance. Since there is a finite fund of money for these internal grants, can we not imagine having a finite fund of emissions that faculty would apply to use.

6. Create a market for emissions within the faculty

Using available websites to calculate emissions for air travel (such as https://www.icao.int/environmental-protection/Carbonoffset/Pages/default.aspx), faculty could plan and calculate emissions for a year's worth of air travel. Every faculty member could be able to claim a set amount based on the 2019 baseline value. Unused emissions could be entered into an emissions market where individuals might be able to 'bid' on those emissions for use beyond their personal allotment; or, a fund could be created whereby offsets are purchased through research grants or other sources of money to purchase unused CO_2 credits.

Future Research

1. What are the GHG emissions from Associate Faculty travel to teach on-campus at RRU?

RRU brings in sessional ('associate') faculty (AF) from around North America and the world to teach in our on-campus residency programs. The cost of travel for an AF is not included in the Finance triplog, but is likely part of the personal service contracts for each person. As there appears to be no centralized location for this information, each school/ college would have to be contacted to look through contract data for AF from 2019, see whether they were paid to travel, and from where their travel would have originated.

2. What is the emission load from student travel to RRU?

Students coming to programs often attend two or three multi-day residencies through the course of their studies. Many students come to RRU from across Canada; however, as a result of aggressive marketing, a significant number of students travel long distances from Asia, Africa and South America to attend RRU. Calculating the contribution of student traavel will help to give a fuller picture of our influence in generating GHG emissions.

"... we found that emissions from air travel, distance, and number of flights taken were unrelated to academic productivity as measured by h-index (adjusted by academic age and discipline) or to an academic's area of interest... Instead, we found that academics who were further in their career and academics with higher salaries took more trips and were responsible for greater emissions than their colleagues" (Wynes et al., 2019).

Acknowledgements

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"It is, in the end, impossible to get around the fact that if CO_2 emissions from flying are to be reduced by 50 per cent in 10 years, that goal will not be attainable unless we significantly decrease the volume of flying" (Pargman et al., 2022, p. 137).

Appendix 1: Excerpted from *Measures for Academic Air Travel Reduction* (Kreil, 2020)

Level 1: Individual researchers

Category	**Measure**
Monitoring	Voluntary carbon tracking
More efficient flying	Combining multiple purposes into one trip (both for yourself and for people you invite)
Regionalizing	Prioritizing field trips with students to short distance destinations, or reducing field trips
Rules of thumb	Skipping every other international conference you would have gone to otherwise
Rules of thumb	Only flying for major, not poster, presentations
Rules of thumb	Only flying if the same journey on the ground takes more than a certain amount of hours
Rules of thumb	Always reconsidering each trip
Rules of thumb	Stay as many days as the flight takes in hours
Virtual Communication	Asking to speak virtually when invited to a conference/to give a guest lecture
Nudging and information	Group leaders acting as role models and reflecting with their group on travel cultures practices

Level 4: Institutions/associations

Category	**Measures**
Enabling regulations	Reducing the number of members on advisory boards and academic commissions, especially international ones [1]
Ground travel	Securing ground travel discounts for employees
Financial incentives	Monetary reward for using ground travel, such as accommodation upgrades
Financial incentives	Only funding economy class air travel
Financial incentives	Monetary reward for reduction of air travel
Financial incentives	A pool where every group pays a certain amount of money toward the pool each year and then that money is redistributed based on how many emissions each group has reduced that year
Financial incentives	Internal emissions trading scheme
Financial incentives	Internal climate tax/fund
Limits	CO2 budgets for each group
Limits	Flight limits for certain types of occasions
Limits	Flight limit (absolute, or relative to previous flying levels) per person/unit and time
Limits	Flight ban/limit within a certain travel radius, domestically or to specific destination
Monitoring	Transparency, comparison of flight records/emissions, peer pressure

Monitoring	Mandatory carbon tracking and reporting
Nudging and information	Not having flying listed as the first option by your travel agency/guidelines
Nudging and information	Travel guidelines
Nudging and information	Providing information and raising awareness about the carbon footprint of different transport option
Nudging and information	Providing better information/tools for comparing travel options
Nudging and information	Introducing justification mechanisms that have to be completed when booking a trip (e.g. giving a reason for the trip)
Nudging and information	University travel service should provide ground travel options and avoid suggesting non-direct flights; also present ground travel options more prominently than flight options
Virtual Communication	Developing (and funding the development of) enhanced VC technology and communication channels/practices
Virtual Communication	Social scientific research into how to do effective VC