Calculating PICES carbon emission savings: a brief case study demonstrating significant environmental benefits of holding a virtual rather than an in-person international meeting

Lori Waters, July 2020 - for Vera Trainer, SB Chair.

Overview

Due to the COVID-19 pandemic, the three day 2020 PICES Inter-sessional Science Board meeting (herein after referred to as ISB-2020) was held as a virtual zoom meeting, rather than as an in-person meeting originally scheduled to be held in Vladivostok, Russia, from April 30 - May 2, 2020. The 24 attendees at this meeting represented seven countries: Canada (6), China (3), Denmark (1), Japan (3), South Korea (4), Russia (1), and USA (6). The purpose of this short case study is to demonstrate the quantifiable environmental benefits of reduced CO_2 emissions that result from holding virtual, rather than in-person international meetings, where feasible.

Method

The carbon calculations outlined below were made using the methods outlined in section 2.2 of the following publication:

- Wynes, S., & Donner, S. D. (2018). *Addressing greenhouse gas emissions from business-related air travel at public institutions: a case study of the University of British Columbia*. Pacific Institute for Climate Solutions. https://pics.uvic.ca/sites/default/files/AirTravelWP_FINAL.pdf (*Accessed July 9, 2020*).

Using known addresses for each attendee, Google maps was used to locate the nearest international flight hub to each address. The great circle route distance from each flight hub to Vladivostok International Airport (VVO) was then determined, using Google Earth. The distances were recorded, then sorted into short, medium, and long haul flights, using the values as set out in Wynes and Donner (2018), which are: short <463km; medium 463 - 3,700 km; and long haul >3700 km.

Distance values for each flight duration type were added to create a cumulative total. The cumulative totals were doubled to represent the emissions impact of return flights, rather than one-way flights. An emission factor was applied to each distance total, to garner the CO_2 emissions per passenger kilometre. As PICES-related air travel is always economy class, only economy units for CO_2 emissions equivalents per passenger were applied, as follows: short haul: 0.27867; medium haul: 0.16508; long haul: 0.14678 kg CO_2e/passenger km. An 8% uplift factor was then applied to the totals to "account for the additional flight length due to the re-routing of planes, holding patterns..." (Wynes and Donner, 2018). Lastly, a radiative forcing multiplier of 1.9 is applied to the figures. This figure accounts for the "disproportionate warming influence of high-altitude emissions from aircraft," (Wynes and Donner, 2018).

While the results may be representative of carbon emissions savings, they cannot be regarded as complete, as, despite the 8% uplift factor applied, the use of great circle routes (the shortest distance around the globe from point to point) is not representative of actual flight routing, and the several shorter hops which may be required to reach a destination, and which may therefore represent a greater volume of CO_2 emissions than is presented here. These calculations represent meeting travel only, and do not include emissions related to accommodation or any other meeting requirements. In short, the resulting figures are conservative, and actual carbon savings resulting from travel avoidance may be larger.

Results

As mentioned previously, the 24 meeting attendees came from seven different countries. Calculating the distances from their nearest hub cities to VVO resulted in:

- 1 attendee within Vladivostok (no flights)
- 0 attendee short haul flights, comprising a cumulative distance of : 0 km
- 10 attendee medium haul flights, comprising a cumulative distance of : 10,222 km
- 13 attendee long haul flights, comprising a cumulative distance of : 105,243 km

These distances were doubled to garner return trip totals: 20,444 km medium haul, and 210, 486 km long haul. Applying the emissions factor for flights resulted in the following CO_2 emission totals:

- Medium haul flight total emissions: 3,374.89552 kg CO_2e/passenger km
- Long haul flight total emissions: 30,895.13508 kg CO_2e/passenger km
- **Total flight emissions for all flights: 34,270.0306 kg CO_2e/passenger km**

An uplift factor of 8% was then applied with 2741.602448 being added to the total emissions: 37,011.63305 kg CO_2e/passenger km. Lastly, the 1.9 high altitude radiative forcing multiplier was applied, resulting in total carbon emissions for the cumulative flights of: 70,322.10279 kg CO_2e/passenger km. This can also be expressed as 70.322 metric tonnes of CO_2.

Discussion

By avoiding one three-day international meeting of 24 attendees, PICES was able to prevent the emission of over seventy tonnes of CO_2 from entering earth's atmosphere. This savings of nearly three tonnes of CO_2 for each attendee is the equivalent of removing more than fifteen cars from the road for one year. Attending a virtual three-day meeting, rather than travelling to Vladivostok, helped PICES participants to significantly reduce both PICES and their individual carbon footprints.

Other ways of expressing the carbon savings, according to the EPA's Greenhouse gas equivalencies calculator[1] with the individual carbon savings being the equivalent of:

- removing 15.28 passenger vehicles from the road for one year;
- avoiding passenger vehicle travel of 280,824 Km;
- home energy usage for over 8 homes for one year;
- not burning 29,954 litres of gasoline, 35,146 kilograms of coal, or 163 barrels of oil.
- CO_2 taken up by 91.8 acres of forest in one year, or 1,163 tree seedlings grown for ten years.

In conclusion, there is quantifiable value in PICES considering virtual meetings when possible, as demonstrated by the carbon savings garnered by avoiding this one short international meeting that had relatively few attendees, yet resulted in significant carbon emission reductions through the avoidance of travel. PICES could consider reducing travel to meetings in future as a viable way of contributing to global carbon emission reductions, in keeping with its desire to transition to less-carbon intensive activities.

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[1] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator