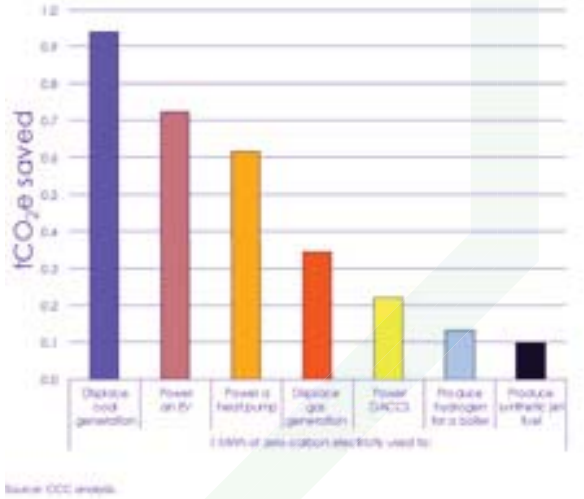
Figure 3. Greenhouse gas emissions saved from 1 MWh of zero-carbon electricity across sectors[7]



As demand for electricity grows, so does the risk that renewable electricity supply won't be able to match it, prolonging the use of fossil fuels.

Conclusion

All technical options for reducing greenhouse gas emissions from aviation have serious limitations. While the development of new technologies is helpful, it cannot be an excuse to delay immediate emissions reductions to mitigate the climate crisis and meet the goals of the Paris Agreement. The only way to effectively reduce aviation emissions is to reduce air travel.

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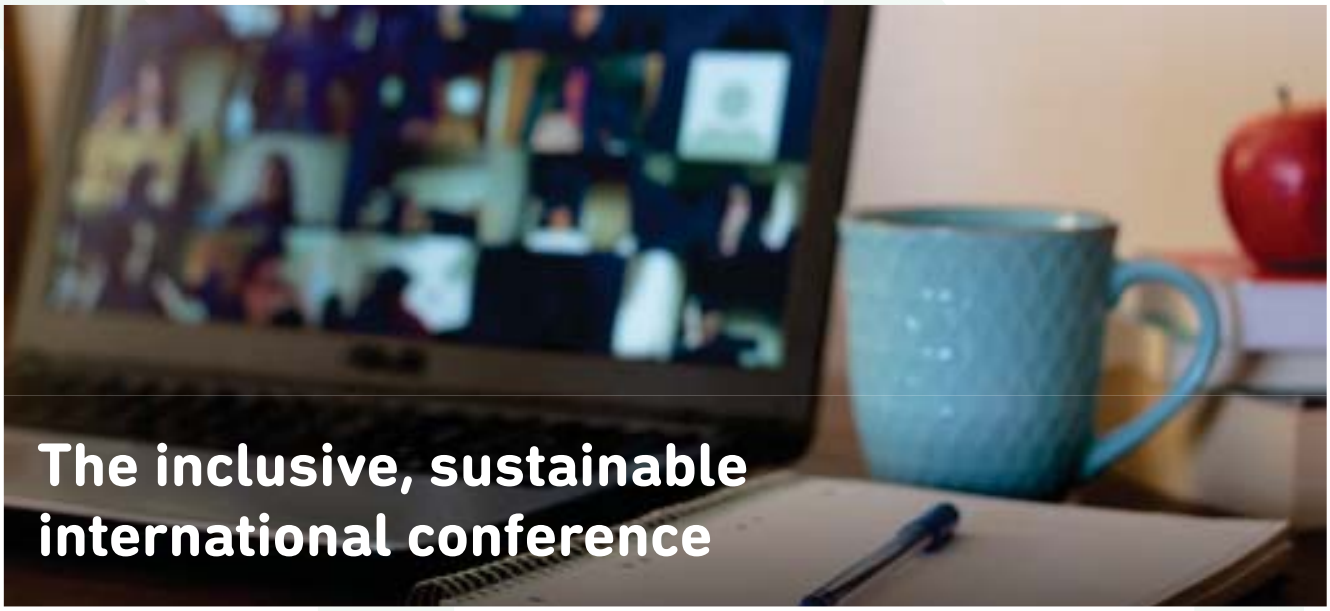

The inclusive, sustainable international conference

How do we reconcile the benefits of scientific gatherings with tackling the climate emergency? **Richard Parncutt**, University of Graz, has trialled a potential solution.

We academics like to see ourselves as smart and good. We creatively solve problems by looking at complex issues from different angles – that's smart – and our lives are devoted to the idealistic and relentless pursuit of academic truth (however defined) – that's good.

It ain't necessarily so. Before COVID-19, frequent academic flyers probably belonged to the global top 1% of climate destroyers. Typically, half our carbon footprint was from flying. Today, as the planet approaches multiple irreversible climatic tipping points, many of us are still planning conventional single-location academic conferences and encouraging colleagues on other continents to burn a tonne of fossil carbon each to get there.

Worse, many are still pretending not to understand. When international academic conference traditions are questioned, our first impulse is to feign polite surprise. Surely, when people from different continents get together regularly, international conflict can be prevented?

That may be true, but international conferences can also be seen as a kind of colonialism.[1] Traditionally, most participants belong to the upper middle class of richer countries. Although we could pay for the trip personally, we often get research funding. Colleagues in less-rich countries can seldom afford the total cost (travel, hotel, registration) or apply for funding. Students in richer countries may find funding or manage to cover the costs, and conference attendance helps them to get an academic position, but that also perpetuates colonialism. Speaking of which: global heating is caused mainly by the Global North, but those who suffer the most will belong to the Global South. For billions of people, climate change is a matter of life and death.

Most academics agree that their conferences should be more inclusive and sustainable, but few realise that these two goals can be achieved simultaneously without sacrificing the motivating effect of the 'conference experience'. To find a solution, we need to train what cognitive scientists call our 'spatial-temporal reasoning'. Imagine a distributed conference program, in which the presentations and other events are organised spatially by geographic location and temporally relative to a 24-hour clock. Imagine that all hubs are nominally equal (resist the idea of a central location with satellites).

There are two kinds of internet-based audio-visual communication: high-quality one-way, transmitted with a short delay (e.g., YouTube); and almost instantaneous, lower-quality, two-way (e.g., Zoom). In a multi-hub conference, every event at every hub can be streamed simultaneously in both ways, each channel acting as a backup for the other. For a given talk, any number of hubs can pick up one or both streams. When a live audience at a hub watches a virtual presentation, the local technician can show the one-way stream for the presentation proper and switch to two-way communication for the discussion

Considering time-zone differences, and respecting normal local working hours, daily real-time communication is possible between any two hubs, anywhere in the world, if the end of the working day is 12 hours after the start. So we need a siesta in the middle of the day. In the morning, each hub can communicate with hubs toward the East; in the evening, toward the West. If the program at each hub is divided into two four-hour slots separated by a four-hour siesta, and the hubs are eight hours apart, the evening sessions at one hub coincide exactly with the morning sessions at another. Sessions missed during the night can be watched later as YouTube videos.

The first planning step is to establish three 'reference hubs' that are equally spaced around the globe, hours apart (check time zones at timeanddate.com). In the Northern summer, they could be in London, Tokyo, and Los Angeles; or Berlin, Sydney, and Phoenix. At those locations, the program might run from 9–13.00 and 17–21.00 each day. Next, add hubs in time zones within about two hours of reference hubs (bigger deviations can be tolerated by smaller hubs). The earliest local program might be 7–11.00 and 15–19.00; the latest, 11–15.00 and 19–23.00. That way, a 7-hub conference can have one hub each in Africa, Europe, India, East Asia, Australia, North America, and South America.[2]

Any number of hubs is possible if the organisation is decentralised, each hub choosing freely from offerings of other hubs. Locations that cannot be included in a given conference for timing reasons can be included in a later conference by shifting the reference hubs or holding the conference in a different month, considering variations in daylight saving.

Conferences can be co-ordinated by the establishment of global reference hubs equally spaced around the globe and running conference programs in the local timezone.

For an individual participant, a multi-hub conference means repeatedly choosing among parallel live and virtual talks. In coffee breaks, informal group meetings mix real and virtual communication, and can be planned in advance. Researchers interested in specific issues can find each other and establish new collaborations.

The advantages of such a conference can outweigh the disadvantages, even without considering emissions. Disadvantages include not meeting distant colleagues in person; not seeing many talks live; and not visiting a new country. Advantages include a new balance between local, regional, and international; frequent face-to-face contact with regional colleagues; a larger, more diverse conference; new participation by colleagues from less privileged countries; establishment of academic disciplines in new countries (a kind of development assistance); saving money (spending it instead on funding for doctoral students or development assistance); and saving travel time.

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