

Life Cycle Assessment of the 2021 AEESP Virtual “Appetizer” Event

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Introduction

The July 2021 AEESP Virtual “Appetizer” Event was a two-day, entirely virtual conference that brought together 374 professors, students, and other leaders in research and education in environmental engineering and science to collaborate, network, and learn. While events like these present advancements in environmental conservation and education, previous studies have demonstrated that conferences, particularly when held in-person, are resource-intensive and have a high carbon footprint, contributing to the acceleration of climate change (Hamant et al., 2019; Neugebauer et al., 2019; Hirsch & Hilty, 2002). This new AEESP Appetizer event provided a unique opportunity to compare the environmental impacts of a virtual and an in-person event. It also supplied useful information to conduct a preliminary assessment of the relative advantages and limitations of the different conference modalities and to identify considerations for future AEESP events.

Methods

The process-based environmental life cycle assessment of the virtual event hosted by Washington University in St. Louis, Missouri University of Science and Technology, Southern Illinois University Edwardsville, and University of Missouri considered all processes in preparation and execution of the virtual “appetizer” event that were a direct result of the event’s occurrence. These include paper manufacturing and waste, electricity consumption, and transportation processes. Factors such as computer and car manufacturing and waste were excluded from the system boundary, as their use for the virtual event execution were considered an insignificant portion of their lifespan. Paper and electricity use data in preparation of the conference were collected from Washington University in St. Louis staff, the conference organizing committee, and the AEESP Student Services Committee. Electricity used by individuals attending the event was determined using login times collected by the virtual attendee hub, and the percentage of individuals who commuted to their offices to attend the virtual event was assessed by a post-event survey.

The assessment that was conducted using this data employed the US EPA’s Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI). This assessment considered seven of the TRACI impact categories: acidification (kg SO₂ eq), eutrophication (kg N eq), freshwater ecotoxicity (CTU eco), global warming (kg CO₂ eq), human health particulate matter (PM 2.5 eq), ozone depletion (kg CFC-11 eq), and smog formation (kg O₃ eq).

Results

The assessment of the virtual event found the workplace commute had the largest influence on most impact categories, as seen in Figure 1 (*next page*). The commute was determined by a U.S. Bureau of Transportation study which found that the average commuter traveled 24.1 kilometers,

or 15.0 miles, to reach their office (2003). For this assessment, the conservative assumption was made that all individuals who commuted, 37.3% of conference attendees, operated a gasoline-powered vehicle this distance to their workplace to attend the virtual event. In particular, the virtual event emitted 2550 kg CO₂ eq total, which is roughly equivalent to the emissions of one person flying round trip from New York City (EWR) to Los Angeles (LAX) four and a half times (“Carbon Emissions,” 2016). The processes associated with the commute contributed 2480 kg CO₂ eq, or 97.1% of the total. Further, the virtual event emitted 310. kg O₃ eq total, with the commute contributing 306 kg O₃ eq, or 98.8%. Electricity consumption most significantly impacted freshwater ecotoxicity because of nuclear fuel extraction, processing, and transport, with the event contributing 1330 comparative toxicity units (CTU), ecotoxicity potential. 69.7% of the overall CTU, ecotoxicity potential comes from the US electricity consumption mix and 27.9% of it is a result of commute processes.

In addition to the comprehensive life cycle assessment conducted of the actual virtual “appetizer” event, an approximate input-output environmental life cycle assessment of the 2021 event was conducted as if it was held in-person. The same paper and electricity processes were considered as the actual virtual event, in addition to new transportation, catering, and accommodation processes based on the number of virtual conference attendees, previous studies, and current economic rates of expected services (Neugebauer et al., 2019; Washington University, 2021). As anticipated based on past literature, the impacts of the theoretical in-person event were substantially greater in all impact categories considered in this assessment as compared to the actual virtual event. In most categories, the impacts are at least ten times larger, as seen in Figure 2 (*next page*). Ozone depletion potential is over 250 times greater, eutrophication potential is nearly 100 times greater, and human health, particulate matter, potential is nearly 70 times greater.

Discussion

The comparison between the actual virtual event and theoretical in-person event indicates that hosting an academic conference in an entirely virtual space dramatically reduces environmental impacts associated with the conference. However, the environmental benefits of transitioning from in-person to virtual are not the only factors to consider in the construction of a better conference model.

Successful environmental conferences should take action to minimize environmental impact, but they should do this without reducing the educational value of the gathering, as the dissemination of knowledge is often the primary goal of an academic conference. Although almost all attendees of the 2021 AEESP event agreed that the virtual event increased accessibility and flexibility, most individuals expressed that they felt the virtual event provided inferior networking opportunities as compared to an in-person conference due to the inability to interact with colleagues in a casual setting. While the economic barrier to entry was lower for the virtual event, the consensus is that the social barrier to entry felt higher. Students expressed having difficulty finding an opportunity to chat

with potential contacts and employers. Professors and professionals indicated that they missed eating meals and having impromptu conversations with colleagues about their field. Many individuals expressed in the post-event survey that they were unsure if they would take advantage of virtual engagement opportunities of in-person events if offered.

It is difficult to quantify environmental, economic, and social factors—including diversity, equity, and inclusion—on the same scale, and priorities among these categories are unique to each individual. As such, it is important that AEESP and future conference organizers offer options that allow event attendees to make decisions that align with their personal values. In-person conferences should be held as there is not a virtual equivalent to in-person networking, but those conferences can offer virtual engagement options to increase accessibility and reduce environmental impact. Although not an ideal solution, conference organizers could consider the benefits and drawbacks of purchasing carbon offsets for individuals that choose to attend events in-person. Post-pandemic, AEESP should consider holding entirely virtual events and workshops when appropriate. As individuals, when attending in-person events, AEESP members may want to think critically about their modes of transportation, food choices, and accommodation. Choosing more sustainable forms of transportation can significantly decrease global warming potential, as well as other impacts. Finally, host institutions could allow individuals to make these decisions by offering accessible and sustainable options to conference attendees. For example, the 2022 AEESP conference held at Washington University in St. Louis will offer on-campus accommodations in addition to having an affiliate hotel and will cater food appropriate to the number of conference attendees while still offering a variety to those with dietary preferences. Accessibility to all should be a primary goal of AEESP leadership and conference organizers, and this often means offering options. However, increasing accessibility without decreasing sustainability is often a complicated matter, and one that warrants further study.

Next Steps

The organizing committee of the 2022 AEESP Research and Education conference is considering the findings from this preliminary research in

their plans for the upcoming conference in St. Louis. While the life cycle assessment of the 2021 event considered a theoretical event, the assessment framework developed as a result will be used to conduct a comprehensive life cycle assessment of the actual 2022 in-person conference. It will be the first life cycle assessment to systematically compare the impacts associated with hosting a virtual and in-person conference. Research following the 2022 event will also contribute to a broader understanding of social and economic factors related to conference modalities in the hopes of constructing a more sustainable and equitable academic conference model.

References

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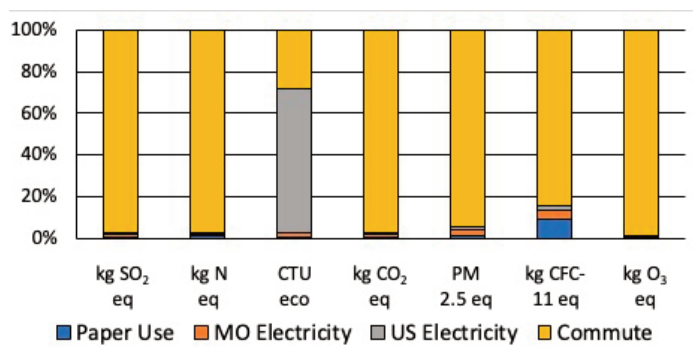


Figure 1: The percent contributions to impact categories of each process undertaken in preparing for and executing the 2021 virtual “appetizer” event. The U.S. electricity consumption mix includes conference preparation not conducted by Washington University in St. Louis staff and the 2021 event execution. The Missouri electricity mix encompasses preparation activities conducted by Washington University staff.

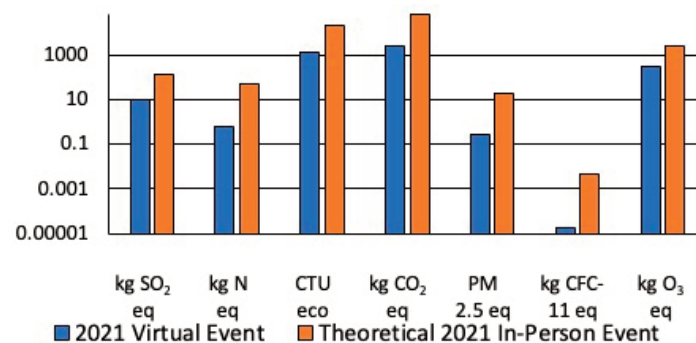


Figure 2: Logarithmic comparison of impact categories between the actual 2021 virtual “appetizer” event, including the impacts associated with commuting, and the same event if it were theoretically held in-person.