A MEETGREEN WHITEPAPER

How We Meet Matters
Digital Event Carbon Accounting

Why It Matters

How does the carbon footprint of a digital meeting compare to convening in-person? Businesses are more focused than ever on reducing the carbon impacts of their activities and understanding those impacts can play a meaningful role in helping shape an organization's emissions goals, targets, and reduction strategies. If you have ever wanted to learn more about digital and physical event assessment methodologies rooted in real-world case study examples, this white paper on *Digital Event Carbon Accounting* provides answers to these questions and sheds light on critical pathways to a more inclusive and sustainable planet.

QUICK LINKS

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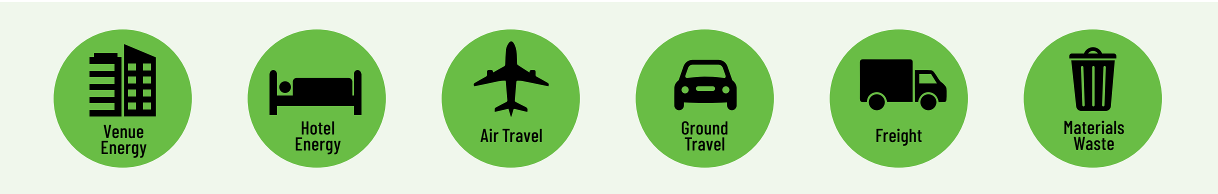
Why Events?

Events, both digital and physical, play a larger role in our understanding of emissions than meets the eye. We know from assessments of in-person gatherings that 90% or more of a physical event's carbon footprint comes from simply "getting there and back." We also know these impacts can be significant. At MeetGreen alone, our event portfolio's staff and attendee travel, decreased by 565 million km (and 79 million kg CO2e!) between 2020 and 2019 directly as a result of convening in digital formats. To put this figure in perspective, that is equivalent to **734 trips to the moon and back.**

Over the past 27 years, MeetGreen has been collecting emissions data from events it has managed or consulted on. Common sources of **physical event emissions** can include:



Through this robust body of information, MeetGreen has been able to benchmark in-person trends, averages, and identify outliers. Of particular interest then is:

> *How does our physical event data compare against the sudden transition to a fully-digital events industry in 2020 and early 2021—especially in terms of the carbon emissions of how people convene?*

To find out, MeetGreen began refining its methodology to collect emissions data from digital events. Common sources of **digital event emissions** were found to include:

A WORD ABOUT TERMINOLOGY

This white paper uses the following terms interchangeably:

Physical and *In-Person*

Digital and *Virtual*

Carbon, Emissions, and *CO2e*

What follows are examples of events measured both in digital and physical formats, and the methodologies used to calculate them. In total, 17 events managed or mentored by MeetGreen were measured both digitally and physically in 2020, and cumulatively saved 79,418,230 kg of CO2e through convening virtually. Colloquially, MeetGreen refers to these comparisons as "UnCarbon Assessments" in reference to the significant emissions savings found between in-person and digital event formats. We believe the findings in the following paper are striking, compelling, and yet another reminder that:

> *How we meet matters, particularly when it comes to carbon emissions.*

So what do these event comparisons look like in the real world? ➡

Case Study #1

Digital Event 2020

Views: 7,538

Streaming Hours: 9,272

Location Data: By Region

Emissions

METHOD 1

458 kg CO2e

METHOD 2

1,993 kg CO2e

Physical Event 2019

Attendees: 788

Days: 2

Location: Southwest United States

Emissions

594,930 kg CO2e

59,295 kg CO2e

32,003 kg CO2e

14,997 kg CO2e

5,592 kg CO2e

Total = 706,816 kg CO2e

Digital Emissions Methods

You'll notice a range in emissions between METHODS 1 and 2. More on how they are calculated in the next section, but for now let's look at a few factors specific to this event that contribute to the difference:

Server Renewable Energy | METHOD 2 calculates energy at the data center level separately, and in this case the data center hosting the streaming content was powered by 100% renewable energy, reducing the total emissions by 26 kg CO2e.

Location | METHOD 2 takes the end user's location into account, and in this case the majority of the videos were watched in locations that sourced a higher than average percentage of their power from renewable sources, reducing their footprint.

A WORD ABOUT THE CASE STUDIES

Case Studies 1 & 2 are based on actual events that MeetGreen measured. Both studies were held in-person in 2019, and digitally in 2020. The findings in these two case studies follow the same trends as the 15 other events that MeetGreen measured in 2020.

Digital vs. Physical Emissions Comparison

The 4x difference between the two digital event calculation methods is significant, but represents a small fraction when compared to the physical event footprint. If METHOD 2 is used, the higher of the two methods, **the 2019 physical event had a 355x higher emissions footprint than the digital event in 2020!** To put that into context, the digital event that provided over 9,000 hours of streaming content emitted as much CO2e as 3 one-way flights from San Francisco to New York City.

Case Study #2

Digital Event 2020

Attendees: 900

Streaming Hours: 18,000

Emissions

METHOD 2

3,870 kg CO2e 2e

Physical Event 2019

Attendees: 969

Days: 3

Location: West Coast United States

Emissions

1,392,817 kg CO2e

13,847 kg CO2e

10,651 kg CO2e

2,296 kg CO2e

Total = 1,419,611 kg CO2e

Streaming Emissions

Location, device, and resolution data was not available for the digital event in Case Study #2, so only METHOD 2 was used. Even if we apply a ratio of 1:4 as shown between METHODS 1 and 2 in Case Study #1, the digital emissions are 367x higher than physical event emissions.

Air Travel Emissions

Of the 1.4 million kg CO2e emitted in 2019, 98% was from air travel. This ratio of flight emissions to total emissions is consistent with the average typically seen at physical events. Emissions from local energy use, such as hotel and venue energy, are usually higher than that of a digital event, but within the same order of magnitude.

Let's take a closer look at how digital events are calculated!

Digital Event Emissions Methodology

As we've seen in Case Study #1, two different methods can be used to calculate digital event emissions. The differences exist because all events are not created equal, and depending on your needs and the availability of specific data, different methods may be used. A tech firm, for instance, may be interested specifically in the energy consumed from streaming and have access to specific streaming data. While another event might be interested in an easy calculation and have limited data availability. There is merit to each, and it's up to the unique situation inherent in each event to decide which is best.

METHOD 1 : Streaming-Specific

METHOD 1 calculates the energy required to stream video at the device, data transmission, and data center levels. A full analysis using Method #1 relies on details about the server/network used, and end user information including device type, internet type, resolution, and server provider. Let's take a look at each:

DEVICE

Different devices have different energy demands. A smartphone, for instance, is extremely efficient due to its small screen and R&D innovations over time to maximize battery life. If the end user streams on a TV or PC, however, the energy used at the device level can become a significant portion of total streaming energy. Although the device type can significantly impact streaming emissions, it's uncommon to have access to this information, and assumptions have to be made. Netflix, for instance, reports that their users stream on a TV 70% of the time, laptop (15%), tablet (10%), and phone (5%). A digital conference, however, will likely be viewed on a laptop/desktop most often.

RESOLUTION AND FRAME RATE

The higher the video resolution and frame rate, the larger the transferred file, increasing the streaming energy demands. Video quality, or resolution, and frame rate change the size of a video file by orders of magnitude. Streaming a video at 360p transfers about 315 mb/hour, while streaming at 720p (30 frames per second (fps)) requires 1,240 mb/hour, about 4x more. It's not uncommon to see YouTube videos at 4K 60 fps. At that resolution and frame rate, an hour-long video is 12.9x larger than a 720p at 30 fps video.

LOCATION

Depending on where you and the data centre are located, your carbon footprint from energy use varies. A video streamed in Kentucky, for instance, emits 4.4x more CO_2e than a video streamed in California solely based on clean energy used at that location. By using the percent of renewable energy sourced at each unique location, the final energy footprint is more accurate. Some streaming services, such as YouTube, provide location data for some end users, but it's usually only a subset of the total. In the absence of precise location data, country or worldwide averages can be used, but these averages typically don't account for population, and can't predict the streaming location specific to your users.

PHYSICAL MATERIALS AND SHIPMENTS

Although not technically part of the energy needed to power event streaming, physical items such as swag and food may still be shipped to attendees at digital events, and can make a huge impact on event emissions. Not only are there lifecycle emissions from producing physical materials and packaging, but items are often shipped by air, and perishable food may require overnight shipping on refrigerated transport. It was found that the emissions footprint from shipping a single box to each attendee at a digital event in 2020 made up almost 95% of total event emissions.

OTHER FACTORS

There are many additional factors that can affect streaming video energy use. One major component to consider is which data center is used, and their efficiencies and environmental commitments. As server technology and AI advance, data centers become better at storing and accessing data, reducing their energy demands. There are also significant renewable energy commitments from each of the three major server providers: AWS, Google, Microsoft.

Even knowing all of the information above, many variables affecting real streaming energy use will remain unknown. Perhaps the end user has solar panels installed, or is enrolled in a renewable energy program with their utility company. Maybe their connection is uncharacteristically slow and only allows them to watch in 360p, or their internet is down and they have to stream from their cell phone. Factors on this scale will always exist, and without knowing if, and by how much, they impact specific streaming data, a more universal calculation can be used like in METHOD 2.

METHOD 2: Auxiliary Energy

This method calculates streaming energy use by broadening the scope to account for other energy consumed at home (HVAC, appliances, lights), instead of measuring only network and data center energy. Since country-wide and state-specific average household energy use is tracked consistently, it's easy to obtain an updated average. This method assumes that as an end user streams content, they also use other energy that wouldn't be needed if the home was unoccupied. The result is a higher average emissions output when compared to the first method, which can act as a buffer to account for unknowns and worst case scenarios mentioned in the previous section.

The example equation below shows how a simple emissions calculation would work for an end user residing in the United States. The emissions per unit of energy number has been reduced to account for the United States average renewable energy use. Renewable energy sourcing in the United States varies widely by state, so a more accurate calculation can be made by knowing the proportion of streamers in each state, and calculating their emissions separately. The content might also be streamed internationally or primarily from another country, in which case the factor would need to be changed. The average emissions per hour streamed in the United Kingdom, for instance, is about 41% lower than the United States.

Here is an example of a calculation for METHOD 2:

FORMULA: PPE*(CO2e/kWh)

PPE - Average per person energy use (kWh) per hour

CO2e/kWh - Emissions (kg CO2e) per unit of Energy (kWh)

EXAMPLE CALCULATION: 0.5 kWh * 0.432 kg CO2e/kWh = 0.215 kg CO2e per US citizen per hour

Pros and Cons of METHOD 1 and METHOD 2

Like with any other lab-tested methodology, there are assumptions that need to be made when applied to the real world. This paper presents two possible methods for measurement, both with their merits and limitations. Below is a short list of pros and cons of each.

	METHOD 1 Streaming-Specific	METHOD 2 Auxiliary Energy
PROS	More accurate renewable energy data used More end user data allows for more targeted mitigation strategies	Easy to calculate Allows for a larger audience to internalize energy impacts
CONS	Requires data that may not be available A more rigorous calculation Potentially under represents the energy impact due to technological innovation Doesn't take into account home auxiliary energy use	Potentially over represents the energy impact Not streaming-specific

And what about physical events? ➡

Physical Event Emissions Methodology

Physical event emissions typically fall outside of a company's traditional operational boundaries and are categorized as **Scope 3 emissions**. Since they are far removed from direct organizational oversight or control- the carbon accounting for physical events generally ranges between actual metered data and modeled estimates based on information available. While events can vary in terms of their primary sources of affiliated fossil fuel combustion, MeetGreen methodology for physical event emissions assessment focuses on the following key areas:

VENUE ENERGY | If the venue does not provide specific energy use data, it is calculated based on contracted event square footage factored with US Department of Energy averages for commercial buildings of public assembly. This is then ascribed a region- or state-specific emissions coefficient based on the EPA's eGRID data.

HOTEL ENERGY | The energy used at hotels and accommodations are estimated using the number of contracted room nights and attendee city-specific conversion factors representing "per occupied room" emissions from the Cornell Hotel Sustainability Benchmarking Index 2020.

MATERIAL WASTE | Materials produced for an event, and how they are discarded, has an energy and emissions footprint. MeetGreen collects production information pre-event, and works with venues and hotels to provide waste diversion data post-event. MeetGreen uses Defra, 2020 to determine the emissions factors for different material excavation, production, transportation, and disposal.

Travel & Transportation Impacts: Attendee origin city/state data are sorted and coded to account for probable distances. Travel & transport emissions factors are derived from Defra, 2020.

AIR TRAVEL | Sorted by geography, ascribing estimated round-trip travel distances, and delineating into long, medium, and short-haul flights, for factoring emissions impacts.

GROUND TRANSPORTATION | Local attendees are assumed to travel by car and assigned an average round trip distance. This category also includes airport shuttles, taxi, app-based ride services, bus, and rail.

FREIGHT | Freight includes truck and air transport for all materials shipped related to builds, signage, and A/V. Depending on the scale of the event production, some physical events do not include statistically significant freight metrics.

So what does all of this mean and what does the future hold? ➡

Conclusion

MeetGreen's "UnCarbon" assessments across the last year reflect a clear and significant emissions savings through meeting digitally, averaging a 95-99% reduction, when compared to physical events. Collectively these projects saved a cumulative 79,418,230 kg of CO2e! To put this figure into perspective, that is equivalent to the emissions generated from powering the island of St. Kitts for over an entire year. Considering that MeetGreen used METHOD 2 for calculating most digital impacts, we believe it is possible that these savings were actually conservatively reported.

Looking Ahead

Armed with such stark quantitative insights, it begs the question: ***how can this data inform and improve how we meet from a sustainability perspective?*** One such outcome from the assessment is the potential for articulating more meaningful targets and thresholds for when travel is necessary for our events. If the goal is to reduce future emissions, leveraging the benefits of multiple formats of connectivity can play a vital part. For example, if our two case studies operated at a **50% physical** and **50% digital** "hybrid model" moving forward, it would eliminate ≈50% of associated event emissions!

Additionally, what if our attendees have come to expect a virtual attendance option? Events that continue to offer a robust, engaging digital event component will simultaneously reach more people and reduce their emissions impact. Imagine a world with a greater range of choices for event attendance, with transparent criteria for decision making, and one in which a speaker joins from home instead of flying across the world to give a one-hour presentation.

In this way, findings from the MeetGreen Case Studies can be instrumental as much needed context and drivers towards innovation and the evolution of hybrid meetings. Carbon capture and drawdown technology will need to be effectively paired with overall reduction strategies to achieve global targets, and digital and hybrid events can play a part.

Lastly, although not explicitly addressed in the comparison study, in many cases digital events can increase accessibility for attendees. For example, MeetGreen digital events achieved a 117% increase in attendance along with a 78% increase in countries represented. We feel that this enhanced accessibility coupled with the considerable environmental benefits, makes retaining and enhancing digital event attendance options vital for both our people and planet.

Given the considerable impacts and footprint of our physical events, carbon-saved baselines are an important reminder that our event choices have real world environmental consequences, and that more than ever:

How We Meet Matters.

MeetGreen®