THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

An Analysis of Best Practices for Sustainable Events and Venues in Columbus

Fall 2021

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AEDE 4567: Assessing Sustainability Capstone Course

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I. Executive Summary

Objective

Experience Columbus is a leading force in marketing and promoting the Columbus experience to visitors. The following report will guide Experience Columbus in attracting and hosting sustainable events and conferences in Columbus.

Research Goal

The aim of this research and the purpose of our recommendations is to increase the sustainability of Columbus' events and venues, primarily to reduce carbon emissions and expand regional competitiveness.

Methods and Results

We began by establishing guiding principles to direct our research. We then compiled and consolidated the best practices identified through in-depth literature reviews of established sustainability frameworks and case studies of successful sustainable venues. Through this review and analysis, we determined six categories to target and address the environmental impact of events and venues. These categories include energy, supply chain, waste management, transportation, water usage, and infrastructure. By implementing the practices we have identified, Columbus events and venues will improve their degree of sustainability and minimize their environmental impact by reducing carbon emissions.

Recommendations

Five recommendations were developed in this report for Experience Columbus. The first is to provide a tailored list of best practices to event planners and their suppliers. The second is to encourage event planners and suppliers to implement the best practices and use incentives if necessary. Similarly, the third is to partner with local suppliers whose practices already align with the best practices we have described. The fourth recommendation is to create a system that records and monitors the progress and success of any best practices being implemented. Our final recommendation is to spread the word to event organizers and suppliers by marketing sustainable efforts.

II. Introduction

Events and conferences in Columbus are significant contributors to the city's overall carbon emissions. Around 337,00 metric tons of carbon dioxide are emitted annually, adding to the harm caused to the natural environment (MORPC, 2019). The events industry is energy-intensive and produces significant amounts of waste each year (Wagner, 2019). In fact, the Franklin County landfill, where the waste from Columbus events is disposed of, is one of the largest emitters of greenhouse gases in the county (Burger, 2021). We worked with Experience Columbus to research various sustainability frameworks, standards, and examples using case studies. Using our research, we compiled a list of best practices for events and venues in Columbus. For frameworks, our research focused on the United Nations Sustainable Development Goals (UNSDG), the Events Industry Council (EIC) Sustainable Events Standards and the LEED Sustainable Operations Framework. Our case studies included sustainable services and convention centers that included the Javits Convention Center in New York City, the David L. Lawrence Convention Center in Pennsylvania, Ohio State University's Zero Waste initiative at Ohio Stadium, and Boston's Good2Go car sharing program. It is our intent that these findings will be used to increase regional competitiveness, attract visitors to the city, and help reach carbon neutrality by 2050.

Based on the findings of our research, we determined that creating a comprehensive list of best practices would be the most effective option for Experience Columbus to market sustainability to the events industry. We created six main categories and collected best practices for energy, supply chain, waste, transportation, water, and infrastructure. These categories will serve as a guide for Experience Columbus, as each best practice is followed by a list of action items for the city to take to increase the sustainability of events hosted in Columbus. We highlight various case studies within each of the best practices to emphasize how they have been implemented by venues and cities across the country. They are also meant to strengthen the importance of sustainability in the events industry.

Additionally, we provide recommendations on how to implement these practices and discuss the anticipated limitations associated with utilizing them. Finally, we acknowledged areas that we felt needed further research.

III. Methods

Background Research

In order to familiarize ourselves with sustainability frameworks, we researched a variety of topics which gave us insight into what the world is doing in our fight to be sustainable. The research consisted of analyzing various frameworks and looking at examples of where these frameworks were implemented. Next, we wanted to delve into the effectiveness of the frameworks and how they were implemented. To accomplish this, we analyzed examples of each one in action. From there, we thought critically about what each one is missing and their advantages and disadvantages.

One of our collaborators, Smart Columbus, was able to get us in contact with senior members of the Professional Convention Management Association (PCMA). We spoke with Meredith Rollins, Carrie Johnson, and Tonya Almond to learn more about why they care about sustainability, find barriers to success, and gather relevant information to guide our background research. During this meeting, the members of PCMA gave us great insight into the events planning industry and a better understanding of the EIC framework.

At the end of our initial background research, we decided on three specific frameworks to focus on more directly. The final frameworks listed below serve to narrow our scope and help maintain focus on our project goal.

Framework One: United Nations Sustainable Development Goals (UNSDGs)

This framework was developed by the United Nations General Assembly in 2015. Its goal is to serve as a blueprint for achieving a better and more sustainable future for all people by 2030. The UNSDGs are a comprehensive and well-founded list of standards that are all related to one another. This framework's focus is on development, but not in the traditional sense of increasing Gross Domestic Product (GDP) and other monetary based development. Instead, it focuses on a newer ideology of development that balances social, economic, and environmental sustainability. This framework is the most holistic in its approach to sustainability, tackling ways to reduce poverty, improve environmental conditions, promote economic growth, provide clean and affordable energy, and foster sustainable communities and cities to name a few. It is the fundamental framework that many others base their standards off, such as the Events Industry Council standards described below.

Figure 1: United Nations Sustainable Development Goals

Retrieved from the UN Sustainable Development goals webpage by the UN

Framework Two: Event Industry Council's Sustainable Event Standards

This framework was developed by the Event Industry Council (EIC), an organization of global event industry leaders who recognize the importance of sustainability and endorse sustainable events. This framework draws heavily from the UNSDGs and works to incorporate them into the events industry specifically. This is the framework used by the Professional Convention Management Association's (PCMA) Convening Leaders signature event. This annual PCMA event is important to our analysis because the 2022 Convening Leaders event will be held in Columbus, so it is important that the city is prepared to host this event with sustainability in mind.

The EIC framework recognizes basic environmental practices to be necessities in the events planning industry. Among these practices include the conservation of water, energy, and natural resources, the meticulous management and reduction of carbon emissions, and the importance of responsible supply chain purchasing. The EIC follows seven recognized standards for events, each representing a different aspect of the industry. The EIC standards include event organizer, accommodations, audio and visual production, destination, exhibition, food and beverage, and venue.

Figure 2: EIC Sustainable Events Standards

Retrieved from the Events Industry Council Sustainability Standards and Registry webpage.

Framework Three: LEED Sustainable Operations Framework

The LEED Sustainable Operations Framework was developed by the United States Green Building Council (USGBC) and is one of the most globally used frameworks for sustainable buildings. Compared to the EIC, this framework is less concerned with the broader forces of sustainability and instead focuses on buildings specifically.

The LEED framework delves deep into the building infrastructure and how its amenities operate in the context of sustainability. This framework has seven building-specific standards it employs in its rating system: indoor environmental quality, materials and resources, location and transportation, sustainable site, energy and atmosphere, and water efficiency.

Figure 3: LEED Sustainable Operations Standards

Retrieved from the Oxford Universal Design and Build webpage.

Comparative Analysis

Our next method used was a comparative analysis of the frameworks we selected and Columbus' events industry. This involved using our background research to analyze our frameworks and how they could be applied to improve the sustainability of events hosted in Columbus. Following our project goal, we looked at Columbus' greenhouse gas (GHG) emissions from 2013-2019 from the Mid-Ohio Regional Planning Commission and analyzed what sectors of Columbus' operations were emitting the most greenhouse gases. We used this data to guide our continued research into our frameworks and answer the question of what is

most important to Columbus as a city. We found that solid waste facilities were the largest sector of emissions stemming from Columbus' operations, followed by wastewater and buildings.

Finally, we used the results of our comparative analysis to select only the most effective standards under each of the frameworks to guide our best practices list. The result was a synthesized list of standards that best encapsulates ways to tackle emissions from Columbus' leading sectors. The finalized categories were energy, supply chain, waste management, transportation, water use, and infrastructure.

Figure 4: Finalized Categories

Case Studies

Once we had our categories selected, we looked for case studies that use these best practices. These case studies can be seen as real-world success stories for each of the best practices, helping to emphasize the benefits of being sustainable. We analyzed Ohio State University's Zero Waste initiative at Ohio Stadium, Boston's Good2Go car sharing program, the Javits Center in New York City, and the David L. Lawrence Convention Center (DLCC) in Pittsburgh.

Furthermore, we aimed to have a diverse representation of examples to analyze to provide ourselves with a holistic representation of what is available. These case studies were selected because they excelled in implementing sustainability best practices, and many of them are top-rated buildings or programs recognized by the frameworks described above.

Case Study One: The Javits Center

The Javits Center implemented a sustainability program in 2013 to maximize the upgrades of their building-wide renovation. Their goal was to create a new standard among event venues by exploring innovative ways to conserve energy and improve the quality of life in the community. Their new sustainability program included new energy-efficient Heating, Ventilation, and Air Conditioning (HVAC) units and high-performance bird-friendly glass. These renovations led to the building being accredited as an EIC certified platinum rated building (Javits Center - 2019 Sustainability Report, 2019). The Javits Center has reduced both its overall energy consumption and water consumption through water monitoring controls and underground rainwater collection. The building also features a 6.75-acre green roof that acts as a wildlife habitat, which has lent to groundbreaking research and even has an entire acre dedicated to farming produce (Javits Center- 2019 Sustainability Report, 2019). This green roof has lowered the temperature in the convention center's immediate area by almost 2 degrees Fahrenheit (Javits Center - 2019 Sustainability Report, 2019).

Case Study Two: The David L. Lawrence Convention Center

The David L. Lawrence Convention Center (DLCC) is a 1.5 million square foot convention center located in downtown Pittsburg, PA. The DLCC is considered a public investment built to attract tourism to the area to incorporate environmental responsibility into the facility to showcase the benefits of sustainable building design operations (*David L. Lawrence Convention Center 2019 Green Report,* 2020). The building features natural ventilation, daylighting, and water reclamation strategies. The DLCC has been certified LEED Platinum O + M since 2012, which means that the facility excelled in energy and water usage, purchasing recycled materials and products, and diverting 53% waste through recycling, donating, and composting. Their 2019 Green Report highlights other successes such as donating nine tons of food waste to local charities, having 99% of all foodservice containers and serving items be compostable, and recycling wastewater to account for 40% of all water used on-site (*David L. Lawrence Convention Center 2019 Green Report,* 2020).

Case Study Three: Ohio State University's Zero Waste initiative at Ohio Stadium

Ohio Stadium began their Zero Waste program in 2011, becoming one of the largest stadiums to attempt zero waste in the country. In most corporate settings, being zero waste

means diverting 90% or more of waste from the landfill through composting, donating, repurposing, or recycling. Ohio Stadium has been able to achieve this goal after collaborating with vendors to adopt compostable materials throughout the stadium, including napkins, utensils, plates, and trays. The stadium also offers reusable souvenir cups to attendees that can be used during multiple games throughout the season. After switching to compostable materials, Ohio Stadium was able to remove trash barrels from their 75 waste stations throughout the stadium and direct waste to their composting and recycling barrels. The university also makes their zero waste efforts in the stadium public to increase awareness about the importance of diverting waste. In 2018, Ohio Stadium reached a season average diversion rate of 94% (Ohio State Athletics, n.d.). These efforts are made possible through partnerships with local high school volunteers, college interns, student organizations, concessions vendors, and Ohio State faculty. An average of 16 tons of waste is produced during a given home game at Ohio Stadium, so the fact that zero waste status can be achieved is a testament to the effectiveness of the best practices implemented by this case study (Ohio State Athletics, n.d.).

Case Study Four: Good2Go Car Sharing Program

Good2Go is a new income-tiered electric vehicle car share program that provides clean, lower emission transportation to Roxbury, MA. Their overall goal is to help the community to become less dependent on cars, lower gasoline-related emissions, and lower its carbon footprint (Harmon, 2021). The company also focuses on bringing its services to communities where electric vehicles may not usually be available due to pricing and accessibility (Harmon, 2021). This community can rely on this service for affordable, safe, and environmentally friendly transportation (About Good2Go, 2021).

IV. Data Collected

Our team's primary form of data collection was to download data about Columbus' greenhouse gas emissions from organizations like the US Environmental Protection Agency (EPA) and the Mid-Ohio Regional Planning Commission (MORPC). Our goal was to familiarize ourselves with Columbus-specific emissions data and, more specifically, where the emissions stemmed from. We used this information to guide our recommendations for best practices, emphasizing what Columbus struggles with most. Figure 5 depicts the percentage of carbon

emissions for Columbus by operation as a city. As can be seen with the graph derived from the MORPC, the top emissions are waste facilities and buildings.

We also received data directly from our project collaborator, Experience Columbus. This data focused on Columbus's events industry and gave statistics on items such as duration of events, number of attendees, category of events, and revenue generated. This data helped us understand the scale at which our best practices will be working, allowing us to research and select best practices based on the events statistics provided.

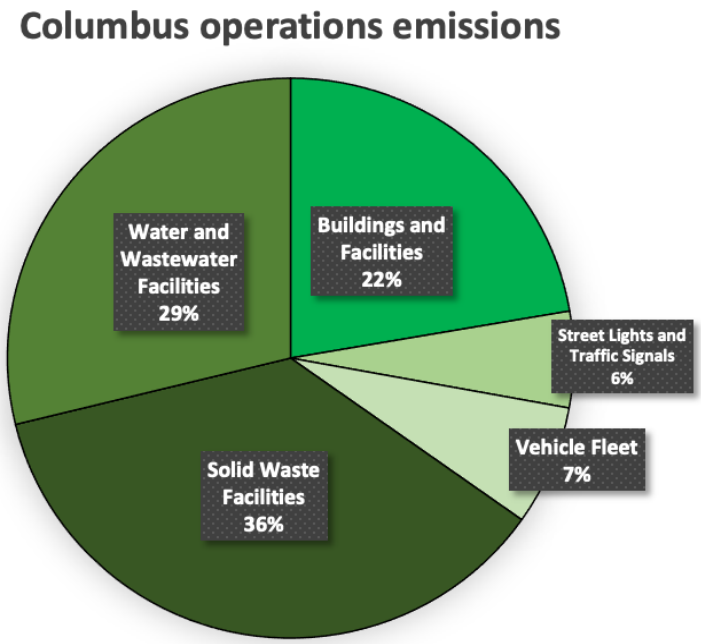

Figure 5: Columbus Operations emissions.

Data collected from the MORPC website.

V. Results

The list of best practices we identified throughout our research process all derived from at least one of the three frameworks or case studies identified above. These practices we listed were ones we found to have the most sustainable impact for events and venues and are meant to guide venues in Columbus with their transition to sustainable events. Our list includes actions that venues can take to transform their energy consumption, supply chain, waste management, transportation options, water usage and building infrastructure. These practices were also selected based on their potential to reduce greenhouse gas emissions in Columbus and increase the city's ability to host sustainable events. We recognize that each venue is unique, our hope is that this master list will provide a portfolio of options that event planners can choose from to make their specific event operate more sustainably.

Energy

Energy generation is the second leading sector in the US in terms of annual emissions. At 25%, ~ 1,650 million tons of CO2e (EPA, 2019), these emissions are a considerable stressor on the country's carbon footprint. During the process of creating the best practices for energy, the Javits Center in New York was selected as a case study for its exemplary performance in energy-saving innovations, building design, and the initiatives that helped the center achieve a platinum EIC rating in 2019. Energy is the biggest emitter of GHGs in the events industry. To host a sustainable event, it is important to be cognizant of this while planning. It is even more important to take proactive approaches, like the ones described below, to reduce the venue's energy consumption.

List of Best Practices

Monitor and record data	•Record and analyze energy usage and costs •Using the recorded data, set attainable short term and long term goals •Benchmark against previous year's data to current year •By doing the above, the site is able to continuously seek areas of improvement and pinpoint reduction opportunities
Update old equipment	•Older equipment can be detrimental to energy saving initiatives •Upgrading to newer equipment can reduce energy usage by 10%-15%
Install LED lights	• 75% more efficient than fluorescent bulbs •Last up to 25x longer than fluorescent
Install a Building Management System (BMS)	•Monitors and automatically controls energy demanding equipment like heating, ventilation, and air condition (HVAC) equipment •Records and analyzes building energy usage, providing valuable data •Uses sensors and predetermined set points to activate equipment when scheduled or required •*Heat/Cooling Requests*: Sensor activated requests that tell the system to heat or cool only the specific area in need •*Optimization Block*: Equation to decide if the building is optimizing its air flow, temperature, and lighting uses •*Optimized Start*: Adaptive system that builds off previous data, activates equipment and systems only when the building is occupied •*Demand Response Program*: Automatic and voluntary reduction in energy usage wherever possible during peak hours
Utilize daylight	•Uses the sun's natural light to illuminate rooms •Reduces energy usage and cost as a result of artificial lighting
Produce solar energy	•Install rooftop solar panels •Generates on site renewable energy that lowers the site's carbon footprint and helps achieve carbon neutrality
Purchase carbon credits	•Purchasing carbon credits from verified organizations •Offset unavoidable emissions to help the site be carbon neutral

Case Study: Javits Center, NYC

- Solar farm saves 1.3 million pounds of carbon emissions annually, the same as removing 300 cars from the road for an entire year
- As a result of the BMS and the voluntary participation in multiple demand response programs, the Javits Center has saved almost $2 million in energy costs over five years

Supply Chain

To produce a sustainable event, it is necessary to ensure that the materials being sourced, and the suppliers being used, are also working to mitigate their environmental impact. Adopting a sustainable supply chain can reduce carbon emissions from transportation and food production, decrease food waste, and eliminate non-biodegradable and nonrecyclable physical waste produced by events. Food, plastic, and clothing waste collectively account for approximately 40% of municipal waste (Porter, 2021; U.S. Environmental Protection Agency, 2021; U.S. Food and Drug Administration, n.d.). These types of waste are particularly problematic for the events industry as many of the materials sourced are single-use and overstocked, resulting in increased waste production compared to typical municipal rates. A responsibly structured supply chain allows for each type of waste to be mitigated. Additionally, this type of supply chain structure facilitates responsible disposal and allows event organizers to set up circular economies to increase the sustainability of events.

List of Best Practices

Eliminate paper and plastic products	•Food packaging, dishware & utensils •Paper towels, toilet paper, napkins, etc. •Signage and romotional / informative paper products •Merchandise
Replace plastic and paper products with sustainable materials	•Bamboo, hemp, corn, or recycled plastics •100% recycled paper & cardboard •Tree-free paper products •Organic textiles •Switch from paper format to digital

Source from local suppliers to reduce emissions from transportation	•Catering •Printing and graphic design •Cleaning supplies •Merchandise
Provide organic and vegetarian options	•Organic production reduces regional use of fertilizers, pesticides & herbicides •Vegetarian options decrease emissions resulting from meat production •Allows for use of onsite food production & decrease catering costs
Produce food onsite through vertical farming	•Efficient use of energy and space •Minimal water input •Negates need for fertilizers, pesticides & herbicides •Year-round harvesting prevents sourcing from long-distance suppliers
Reduce food waste	•Partner with local food banks & homeless shelters to reduce disposal of food •Partner with responsible, sustainable disposal facility: (WM - Waste Management) •Sophisticated waste sorting prevents contamination between waste •Reduce methane produced by landfills •Renewable energy production through use of solar, renewable natural gas production from methane extraction and organic waste processing for energy production

➢ **Case Study:** David L. Lawrence Convention Center, Pittsburgh

- Levy Premium Foodservice (the DLCC's food and beverage provider) maintains 1200 square feet of organically grown heirloom vegetables
- In 2019, 2% of food purchasing was replaced with these roof-top grown vegetables
- The DLCC has a local partnership to produce their own beer branded as "Rooftop Hops" using hops

Waste Management

The events industry is notorious for producing copious amounts of waste. However, hosting a grand event does not have to be wasteful with the incorporation of the best practices listed below. The events industry alone spends $48 billion on food and beverages each year, and an estimated $21 billion of that is spent on food that is wasted (Wagner, 2019). Additionally, the Franklin County Sanitary Landfill is among the county's top three largest emitters of greenhouse gases (Burger, 2021). The landfill is estimated to only have 42 years of use left, so reducing

waste from large-scale events in the Columbus area is critical for reducing carbon emissions overall (Marsh, 2020). These best practices are intended to decrease the amount of waste sent to the landfill and increase waste reduction practices at event venues in Columbus. This list includes three major action items for event organizers, along with steps to take that will make achieving those actions more manageable.

List of Best Practices

Prevent waste before it is created	•Only print handouts upon request •Print documents to be doubsided •Go digital wherever possible, such as using e-tickets, reusable name tags, and reusable posters •Offer drinking fountains and water refill stations •Rent out presentation materials, such as stands •Opt for gifts such as digital discount codes, downloadables, or e-tickets in place of physical merchandise
Divert waste during the event	•Ensure each presenter or company brings materials that are either recyclable or compostable •Educate attendees about waste diversion efforts to spread awareness •Offer composting at the event to reduce food waste being sent to the landfill •Use compostable food containers and utensils
Perform waste audits regularly	•Carry out a waste characterization study in order to identify the biggest sources of waste •Create goals for how to divert waste through composting and recycling streams

Case Study: Ohio Stadium, Columbus

- Diverts 90% of waste produced during home football games through composting and recycling
- Switched to compostable food packaging
- Makes zero waste efforts public
- Tracks progress annually

Transportation

Reducing carbon emissions is the most largely sought-after goal for corporations and venues trying to limit their contribution to climate change. One of the best ways to reduce carbon

emissions is through sustainable transportation. Sustainable transportation is the ability to support the mobility needs of a society in a manner that has the smallest negative impact on the environment. Transportation accounts for nearly 30% of total greenhouse gas emissions and is the most significant contributor to pollution in the United States (US EPA, 2021). The following best practices are intended to help the city of Columbus reduce the amount of carbon emissions being released into the atmosphere by transportation to events. The list consists of four action items for event organizers, including steps on how these can be implemented throughout the city and at event venues.

List of Best Practices

Promote biking	•Install bike racks •Implement bike sharing programs and provide the infrastructure •Set up new bike lanes to protect from poor weather and prevent accidents
Locate event near hotel	•Assists in reducing carbon footprint •Decreases travel distance •Convenient for attendees
Provide electric vehicle rentals	•Electric vehicle rentals can be made available for event attendees •Zero emission technology •Lower maintenance •EV technology saves money on fuel and is energy efficient
Incentivize carpooling, ridesharing, and public transit	•Provide discounted transit fares •Provide easy-to-access information on transportation options •Free parking •Provide food or beverage coupons to attendees who carpool, use public transit, or utilize EV rentals

Case Study: Good2Go Car Sharing, Boston

- Electric vehicle sharing service available to residents and visitors
- Goal is to make Roxbury less dependent on personal vehicles
- Reduces carbon footprint and pollution from gasoline
- Educates community about EV technology

Water Usage

Increases in populations and climate change have been adding to the global scarcity of clean water. Although a significantly limited resource, water can be renewable if managed properly. Water management is, therefore, one of the main factors in the overall goal of sustainable development (El-Nwsany, 2019). Sustainable water management supports social and economic development while protecting the environment and guaranteeing its resources for future generations (United Nations, n.d.). It is an important concept that can and should be integrated into events and conferences in Columbus.

List of Best Practices

Manage sustainable water use	•Increase water collection •Reuse water •Minimize water consumption
Collect rainwater	•Install large rainwater harvesting systems at venues
Reuse greywater	•Greywater systems can enable up to 50% of wastewater to be treated and reused on site for toilet flushing, landscape irrigation, and other potable uses
Track water consumption with monitoring systems	•Data can be used to educate visitors on sustainable water practices taking place at the event •Helps reduce overconsumption •Helps venues track progress over time
Install efficient water fixtures	•Install sensor faucets, which limit the amount of water dispensed •Install aerator tips, which reduce quantity of water dispensed by up to 50%
Perform regular pipe maintenance	•Prevents water waste by detecting leaks early on

➢ Case Study: Javits Center, NYC

- Leak sensors have been installed to alert the Facilities Management Team
- Installed rain sensors, which help to refine irrigation needs on the roof-top farm
- Cooling tower meters have been installed, which help to
- These efforts have helped the Javits Center to receive around $100,000 in credits towards the building's water bill

Infrastructure

Sustainable infrastructure is an important way to help make a venue carbon neutral. It encompasses the designing, building, and operation of sustainable elements into infrastructure. This makes the infrastructure of hosting venues vital to the sustainability efforts of the event. One of the most promising practices for sustainable infrastructure is the introduction of green roofs. The case study used to examine the green roof's impact on the venue is the David L. Lawrence Convention Center (DLCC) in Pittsburgh, Pennsylvania. The convention center has been LEED platinum-certified since 2012. The DLCC hosted the PCMA annual Convening Leaders conference in 2019, the same conference coming to Columbus in 2022.

List of Best Practices

Create green roofs

- Improves air quality
- Decreases waste
- Effective use for rainwater
- Controls urban heat island (UHI) effect
- Energy efficient
- Urban agriculture

Use renewable materials

- Ferrock
  - -Recycled materials like steel dust and leftover ferrous rock from landfill
  - -Traps and absorbs carbon, helps to reach carbon neutrality
- Bamboo
  - -High strength to weight ratio, very durable
- Other possible options:
  - -Precast concrete slabs, recycled plastic, reclaimed wood, reclaimed or recycled steel, hempcrete, and mycelium

Use natural insulation

- Straw bales
  - -Excellent insulation and soundproofing qualities
  - -Contribute to cooler temps in summer and warmer temps in winter
- Plant-based polyurethane rigid foam
  - -Comes from bamboo, kelp, and hemp
  - -Material is rigid and insulating
- Other possible options include sheep wool and cork

➢ **Case Study:** David L. Lawrence Convention Center, Pittsburgh

- Roofs in Pennsylvania climate retain 50% of rainfall on average (100% in summer)
- Plants remove pollutants from air and water totaling 680 pounds of particulate matter annually, equivalent to annual emissions of 255 passenger vehicles
- Provides routes for walkers, bikers, joggers to travel between locations
- Able to produce enough food to replace 2% of its food purchasing
- Showed a 40-50℉ reduction in surface temperature compared to adjacent buildings with no green roofs and had a reduction of 10-20% in heating and cooling costs

VI. Recommendations for Implementation

Through this comprehensive analysis, we developed five recommendations for Experience Columbus to communicate and implement the determined best practices for the events and conferences in Columbus. They are as follows:

1. Select the most appropriate best practice from the list provided above on a case-by-case basis, creating a tailored list of best practices to event planners and their suppliers. Modifying the list of best practices to align with what is relevant to each event and supplier simplifies the information and will increase the likelihood of adoption.
2. Encourage the event planners and suppliers to implement these best practices and offer incentives for doing so. Incentives can also be offered to any visitors who take action to support sustainable efforts. As mentioned in our waste discussion, digital gifts can be awarded to guests.
3. Partner with local suppliers that are incorporating their own best practices. Doing so can hasten the adoption process and allow for a smooth transition to sustainability for the event venues and planners. This also encourages other businesses in Columbus to incorporate sustainability in their business practices in order to partner with event venues.
4. Create a monitoring system that allows for data about each of the six targeted categories to be measured and tracked over time. By measuring the effects of implementing these practices, venues can highlight their successes and learn from their mistakes. From these assessments, event spaces can decide what efforts will further aid in achieving carbon neutrality by 2050.
5. Spread the word. A key aspect to attracting more future events to Columbus will rely on how Columbus chooses to market these initiatives and the impacts that they have made. Advertising campaigns for planned sustainable events can be used to highlight the efforts.

VII. Challenges of Implementation and Further Research

We recognize that financial resources may be a restraining factor in the adoption of these practices. One solution could be to seek out grants or other sources of funding that could subsidize improvements to the venues and events hosted.

In addition to financial constraints, we expect each category to have unique challenges that may make adopting the practices difficult. For instance, diverting waste can be challenging when recycling receptacles become contaminated by unrinsed, dirty, or misplaced items. The supply chain best practices can be logistically challenging to implement if event organizers are sourcing their own merchandise or have their own plan for suppliers. Water use, building infrastructure, transportation, and energy use all have constraints that pertain to the financial resources available and the costs of adopting innovative technologies by retrofitting.

With any sustainability initiative, it is imperative to constantly adapt to new findings and implement innovative ideas that emerge. We feel that continuing this report's research will help Experience Columbus and the broader Columbus area. Our team focused primarily on a qualitative analysis with background statistics to guide our research. It is our recommendation that this report is expanded upon in the future, possibly as a legacy capstone project, with a strict focus on the quantitative analysis of implementation to help show benefits of our best practices.

VIII. Conclusion

There is a growing need and desire for cities to reduce the amount of carbon emissions they produce. There have been countless studies, and the literature is clear; carbon emissions are dangerous to the environment. This push has resulted in cities, like Columbus, setting progressive goals to become carbon neutral by 2050. A key area to focus on is the events industry and venue spaces for large conferences and events.

Our research has shown there are a lot of various frameworks, standards, and other methods to reduce the carbon footprint of events. After analyzing multiple frameworks and case studies, we have synthesized what we found to be a list of best practices specific to the Columbus events spaces. Ours is a comprehensive approach to sustainability that focuses on all three pillars: environment, economy, and society, with an emphasis on becoming a net-zero city by 2050.

Our recommendations for Experience Columbus and the broader events space to implement the best practices are as follows:

- Provide a tailored list of best practices to event planners and suppliers.
- Encourage and incentivize event planners to adopt these standards.

- Partner with local suppliers.
- Record and monitor progress and success.
- Spread the word by marketing the sustainability efforts to event organizers.

Implementing these recommendations will help Columbus become a net-zero city by optimizing building energy usage, improving existing infrastructure, sustainably managing the supply chains, diverting waste from landfills, maximizing water efficiency, and improving transportation to events.

Through this report, we hope to have facilitated a better understanding of the innovative ideas and best practices available for large events and venues to operate more sustainably. Our research and recommendations can be used by Experience Columbus as a tool to encourage sustainable events, establish a working framework, and market to event organizers to show that Columbus is committed to its sustainability goals.

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X. Appendix

Dataset #1: Experience Columbus Data.xls

Source: Dan Williams

Description: This dataset has useful information on Columbus specific events that were used to guide our research and familiarize ourselves with the subject matter such as events, attendees, revenue, dates, length, location from 2015-2019.

Dataset #2: Columbus GHG (Greenhouse Gasses) emissions.xls

Source: Mid-Ohio Regional Planning Commission GHG Report 2019

Description: This dataset has the annual emissions in metric tons for Columbus' operations such as Buildings, Waste and Water Treatment, Streetlights, and Vehicle Fleet, as well as emissions data from 2013-2019.