Convergence of Knowledge and Action: 2022 AEESP Research and Education Conference Sustainability Initiatives

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Concerns about Earth's future have intensified in recent years as a result of anthropogenic climate change. The academic community recognizes the urgency of this crisis, aware that a lack of quick, substantial action to reduce greenhouse gas emissions and cease environmental degradation could result in conditions on Earth which make human survival improbable (Parncutt et al., 2021).

A non-negligible contributor to humans' environmental footprint is hosting events (Toniolo et al., 2017), and particularly events like international conferences which require significant air travel (Bousema et al., 2020; Foramitti et al., 2021; Hamant et al., 2019; Higham & Font, 2019; Holden et al., 2017; Klöwer et al., 2020; Künzli et al., 2013; Neugebauer et al., 2020; Nevrly et al., 2020; Parncutt et al., 2021; Periyasamy et al., 2022; Tao et al., 2021; Van Ewijk & Hoekman, 2020; Yates et al., 2022). Conference Organizers are aware of the environmental impact of these events and that many academics consider conference attendance imperative for the dissemination of scientific knowledge and professional development (Davis & Warfield, 2011; Hamant et al., 2019; Thaller et al, 2020). Thus, a key priority of the 2022 AEESP Research and Education Conference is minimizing its footprint. The following sections outline significant sustainability efforts undertaken by the Conference Organizers.

Food. Food contributes significantly to greenhouse gas emissions, with a 2019 Intergovernmental Panel on Climate Change (IPCC) report finding that the food system emits between one- and two-fifths of greenhouse gases (Sans-Cobena et al., 2020). Furthermore,

greenhouse gas emissions are not the only sustainability considerations, as the food system is known to contribute significantly to terrestrial and aquatic eutrophication, soil acidification, and biodiversity loss (Sans-Cobena et al., 2020).

2022 AEESP Conference Organizers have considered footprint reduction strategies when selecting caterers and menus. A known way to decrease the environmental footprint of a conference is to transition to a plant-based or plant-forward diet (Künzli et al., 2013; Neugebauer et al., 2020; Periyasamy et al., 2022; Sans-Cobena et al., 2020; Tao et al, 2021). Researchers have found that switching from catering to the average diet—calculated "for high income countries and an average energy intake of 2,100 [calories per person per day]"—to a vegetarian or vegan diet results in approximately a 70 or 80 percent reduction, respectively, in both per capita daily reactive nitrogen footprint and greenhouse gas footprint (Sans-Cobena et al., 2020). Of the food available to attendees of the 2022 AEESP Research and Education Conference, 40 percent is vegetarian, with vegan options also available.

Other reduction strategies include sourcing local, organic, and seasonal foods for conferences and mitigating food waste (Künzli et al., 2013). Bon Appetit and Flik, the contracted caterers for the 2022 AEESP Research and Education Conference, prioritize sourcing local, ethical, and seasonal foods (Washington University in St. Louis, 2022a). While grab-and-go lunches will be served in disposable materials, those materials are entirely recyclable or compostable. Washington University in St. Louis has a robust waste diversion program in place, diverting 46 percent of waste to compost and recycling (Washington University in St. Louis, 2022b). The University's zero percent recycling rejection rate and three percent compost rejection rate (Washington University in St. Louis, 2022b) ensures that waste associated with these meals will largely avoid the landfill. Unlike buffet-style meals, the grab-and-go lunches

also require less cooking and do not require continuous heating, thus reducing emissions associated with energy consumption and contaminants which lead to poor indoor air quality (Lee, S. C. et al., 2001).

Banquet Transportation. Given the large number of conference-goers, Conference Organizers thought it important to consider the environmental impact of the transportation commissioned to move people between venues. Though public transportation is widely recognized as fundamental to sustainable urbanization (Miller et al., 2016), and organized transportation is not, the majority of 2022 AEESP Research and Education Conference attendees indicated a preference for organized transportation to the Closing Banquet. Conference Organizers considered encouraging attendees to carpool using personal vehicles and ridesharing services. However, approximately 700 people will be attending the banquet, and Conference Organizers were concerned that the hassle of finding a ride from campus to the Gateway Arch (approximately eight miles) would detract from the conference and cause attendees to arrive at the Closing Banquet late, or not at all. Therefore, transportation from Washington University to Hyatt Regency St. Louis at the Arch will be handled by a private bus charter.

As existing literature establishes, operating an electric vehicle is a great alternative to operating any internal combustion engine vehicle to mitigate greenhouse gas emissions (Del Pero et al., 2018; Jelti et al., 2021; Jwa & Lim, 2018; Requia et al., 2018; United States Environmental Protection Agency, 2022a). However, greenhouse gas emissions are not the only considerations when evaluating the environmental impact of goods and services. Factors that affect air, soil, and water quality are also important, as the health of the planet is not only dependent on global warming. An electric vehicle's impact on these categories is often substantial and largely dependent on the fuel source used to generate electricity. Therefore, an environmental life cycle

assessment is necessary to determine the least harmful vehicle type for transportation to the Closing Banquet.

A back-of-the-envelope environmental impact assessment of four types of buses—compressed natural gas (CNG), diesel, gasoline, and electric—indicates that electric vehicles, in this context, are not necessarily superior to internal combustion engine vehicles.

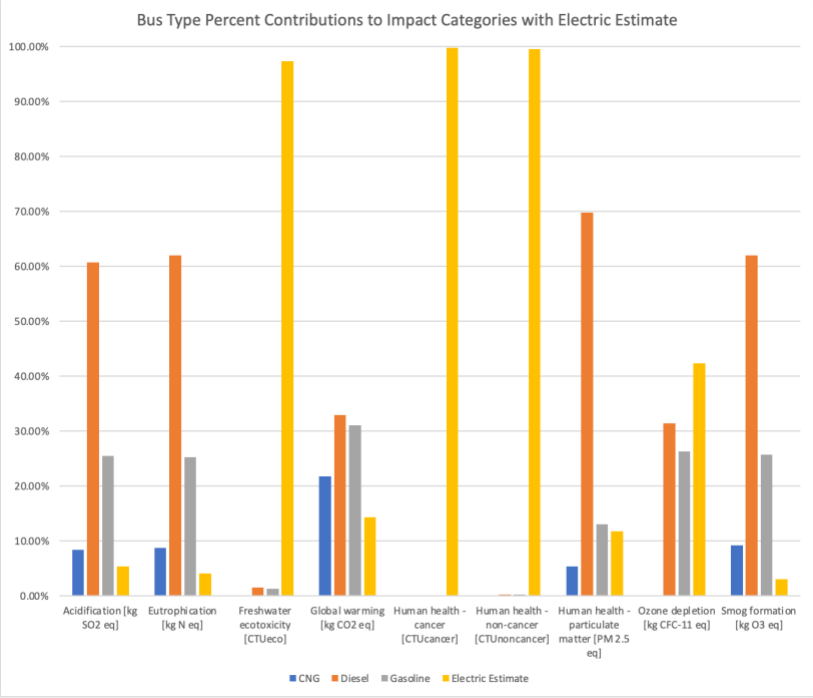

Figure 1: Comparative assessment of different vehicle types and their contribution to various impact categories. Diesel vehicles and electric vehicles have some of the largest environmental impacts.

Compared to the three other vehicle types, electric vehicles perform significantly better in some categories and considerably worse in others (Figure 1). The electric vehicle has a far smaller footprint in acidification, eutrophication, global warming, and smog formation. However, it has a much larger footprint in freshwater ecotoxicity, ozone depletion, and human health, cancer and noncancer. In this assessment, the electric vehicles are assumed to be charged using Missouri's electricity generation fuel sources (Figure 2), which are primarily nonrenewable. Coal and nuclear are the two principal fuel sources for Missouri electricity. Coal combustion is known to contribute to poor air quality which affects human health, and nuclear

contributes thermal pollution of waterways. Consequently, those environmental impacts are exacerbated by operating an electric vehicle reliant on Missouri electricity.

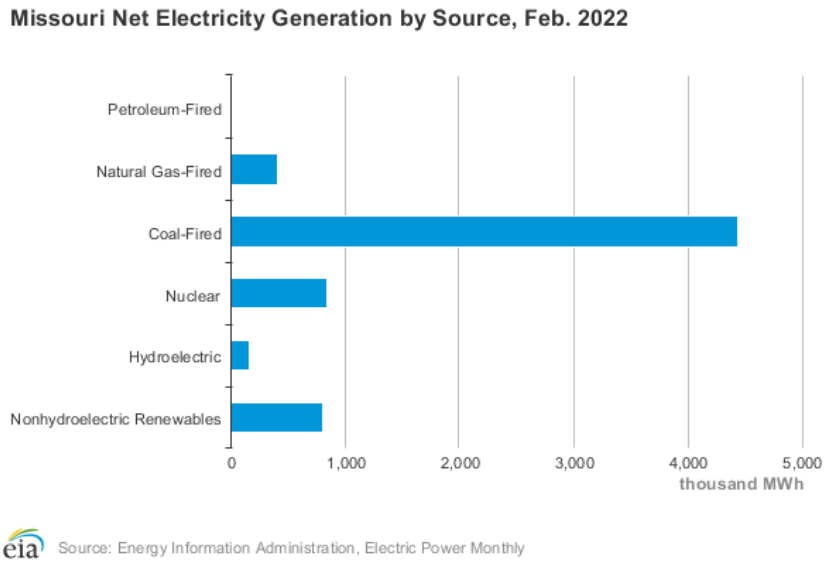

Figure 2: Energy Information Administration's visual summary of the fuel sources for Missouri's electricity mix in February 2022. Coal dominates as a fuel source, though nuclear and nonhydroelectric renewables are also significant contributors (United States Energy Information Administration, 2021).

Furthermore, this assessment only considers the use of these vehicles; it does not consider the manufacturing or disposal processes. Manufacturing of electric vehicles has greater impacts on the environment than its internal combustion engine counterparts (Del Pero et al., 2018; Tabuchi & Plumer, 2021; United States Environmental Protection Agency, 2022a; Xia & Li, 2022). Battery manufacturing for electric vehicles requires critical raw materials like cobalt and lithium, which have been linked to human rights and environmental concerns (Tabuchi & Plumer, 2021), and the critical raw materials are rarely recycled correctly to permit reuse (United States Environmental Protection Agency, 2022b; Xia & Li, 2022).

The assessment and literature review suggest that CNG vehicles may be the best overall choice for transportation to and from the banquet. Unfortunately, that vehicle type is not readily available for charter near St. Louis. Even without CNG vehicles, Conference Organizers

ultimately concluded that the environmental benefits of chartering electric buses did not outweigh the negatives and chose to move forward with internal combustion engine buses.

Other. Conference Organizers took additional steps to make the conference as sustainable as possible, including purchasing potted flowers in place of cut flowers, printing minimal paper, and offering accommodations on-campus. Following the event, the efficacy of these decisions and others will be analyzed by a comprehensive life cycle assessment of the 2022 AEESP Research and Education Conference.

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