Report on the carbon footprint of Swiss music festivals 2022

The first report on the CO2 emissions of the Swiss music festival scene was conducted on behalf of Music Declares Emergency Switzerland by the company Acting Responsibly – with and thanks to the financial support of Migros Kulturprozent.

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Executive summary

This study was conducted between August 2022 and December 2022. The ambition of the study was to get an overall estimation of the total carbon footprint of the festival scene in Switzerland. The study was mandated by *Music Declares Emergency (MDE)* and conducted by the Swiss sustainable event expert *acting responsibly AG.*

The data of 30 festivals or festival-like events was included in this research. The festivals provided carbon-related data through the online tool www.sustainable-events.com or via an excel table. Two festivals conducted a detailed carbon dioxide (CO_2) study which was also included in the research.

The festivals were clustered into three groups: indoor festivals, outdoor festivals without camping, and outdoor festivals with camping. Switzerland's festival market in 2022 was estimated to count 400 festivals or festival-like events. The data provided by the festivals was verified based on the principle of plausibility and reviewed with the festival organizer in case of doubt before it was extrapolated to the total Swiss festival market.

The study shows that in 2022 the festival scene in Switzerland produced CO_2 emissions of approximately 128 thousand tons measured in CO_2 equivalents *(*CO_2e*)*. The lion's share of the emissions (67%) derived from the mobility of the spectators and artists. The food and beverages (10%), the printing of materials (7%) and overnight stays of the artists and staff (6%) were other significant CO_2e emission sources. Energy was the source of 6%, waste the source of 4% of the total emissions. Water use was responsible for less than 1% of the emissions.

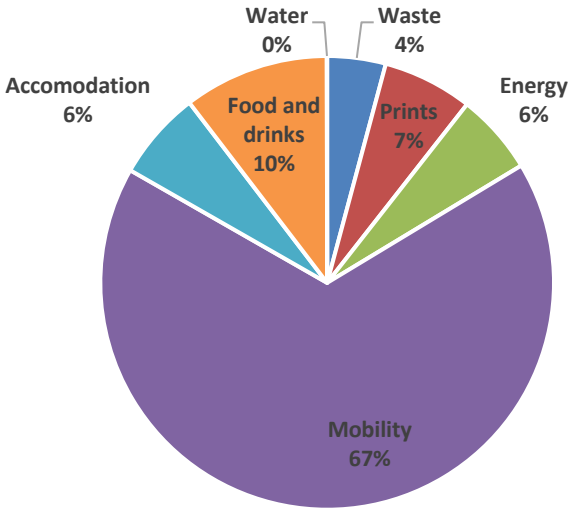

Figure 1 : Shares of each sector in the total carbon footprint of the Swiss music festival scene in 2022

Mobility produces approximately 85.7 thousand tons of CO_2e. The study shows that 27% of the spectators travel to the event by car; they produce 48% of the emissions related to mobility. Air travel, mainly used by the artists, is responsible for 24% of the mobility-related emissions. If festival organizers managed to reduce mobility by car from 27% to 20% in favour of public transport, 9% of the mobility emissions or 6% of all total emissions produced by festivals could be saved. If only 10% of the spectators travelled to the festivals by car, savings would even reach 24% of the emissions related to mobility or 16% of the total emissions. These significant savings of 20.6 thousand tons of CO_2 are equivalent to the annual absorbing capacity of one million trees, a forest of 34 square kilometers in size - nearly the territory of the canton of Basel-Stadt.

Food and beverages are responsible for approximately 13.3 thousand tons of CO_2e. Especially outdoor festivals sell large amounts of food and beverages. Around 15.8% of their total emissions stem from this source. If festival organizers managed to replace 50% of their meals with vegetarian meals, emissions could be reduced by 4%. This equals 390.000 additional vegetarian meals. If they only had vegetarian food options, the number would increase to 9%, the absorption potential of a forest of two square kilometre.

Energy use is responsible for 7.4 thousand tons of CO_2e. If festival organizers replaced 50% of their oil heating systems with biogas, they could save 22% of their energy emissions.

If oil heating systems were completely replaced by biogas, the savings would even reach 44%. These savings are equivalent to the annual heating emissions of 800 households with a modern biogas system.

This research study has several limitations: on one hand, the environmental impact was calculated only with the indicator CO_2e. This indicator allows to quantify the impacts of activities on greenhouse gas emissions and thus on climate change. Impact categories like resource depletion, land use, toxicity, etc. are not taken into account with this method. Other types of emissions such as noise, pollution, and light were not considered in this study. In addition, only a limited number of festivals could provide relevant data. Therefore, the results of this study can be considered a good first estimate of the carbon footprint of the Swiss music festival scene. Future studies should focus on increasing the quantity and quality of the collected data.

We want to express our thanks to the many festival representatives who were ready to review their event of 2022, to “dig up” old documents, consult internal experts and to fill in our data request at the best of their knowledge and belief.

We are confident that this endeavor had a positive side-effect on the contributing festival organizers. We believe that the study helps festival organizers better understand the environmental impacts and options for action in Switzerland and beyond. We hope that it will not negatively affect their intrinsic motivation to organize festivals, but on the contrary will help intensify their efforts to reduce the negative impacts of their festivals and to strengthen their commitment to contribute to social benefits such as joy, wellbeing, and social cohesion. After all, it is these benefits that make our lives worth living and set the ground for a healthy planet for future generations.

Background and objectives

Acting responsibly AG is a consultancy in the field of sustainable event management. The company has developed different tools to monitor and measure the sustainability performance of events. The Sustainable Event Monitoring System (SEMS) covers different sustainability topics such as mobility, energy, water, waste, food and beverages, accommodation, procurement, etc. and also calculates the carbon emissions.
Music Declares Emergency (MDE) is an international environmental organization with an office in Zurich. MDE is interested in conducting a study on the climate footprint of Swiss music festivals. For this purpose, MDE has commissioned *acting responsibly AG* to conduct the work.

The following research question needs to be answered in this study: How many carbon emissions are caused by all Swiss music festivals per year? The baseline year is 2022. The study should provide a break-down by different emission sources. In addition, the study should deliver different scenarios relating to emission reduction measures and their impacts.

The final report will be presented at the M4Music Festival in Zurich, 24-25 March, 2023.

Methodology

Festival categories

The Swiss music festivals are regrouped in three categories for this study:

a) Indoor music festivals
b) Outdoor music festivals with camping
c) Outdoor music festivals without camping

The goal of this categorization is to get an understanding of the impact of activities such as camping and mobility on the carbon footprint of festivals.

Identification of major sources of carbon emissions

To collect accurate and already allocated data, a listing of the activities and the main sources of carbon emissions at music festivals is necessary. *Acting responsibly AG* runs a platform that offers organizers of sport events and festivals the possibility to calculate their carbon footprint. This platform is used for the collection of data in the present study and the following activities are considered:

- accommodation
- mobility
- waste management
- water use
- energy use
- materials used (printing, gadgets, etc.)
- food and beverages

As the mobility of spectators and artists is traditionally responsible for the larger part of emissions, the researchers paid special attention to this data and included the average travel distance by mode of transport as well as the average occupation of car seats for each event.

Data collection

Festival data

The major challenge of the study was to get reliable data on all key emission sources. The ambition of the study was to collect as much data sets of different types of events as possible to get a complete and realistic representation of the carbon footprint of the Swiss music festival scene. All the relevant material and energy flows (inputs and outputs) are taken into account (see listing of activities above).

Carbon footprint calculation

The carbon footprint of Swiss festivals is calculated in kilograms of CO_2 equivalents (kg CO_2e) and tons of CO_2 equivalents (t CO_2e). CO_2e are used to quantify the greenhouse gas effect of gases other than carbon dioxide (CO_2) and use carbon dioxide as a reference. Characterization factors (CF) to convert emissions into CO_2 equivalents were defined by the Intergovernmental Panel on Climate Change (IPCC) and take into account the activity of the gas in the atmosphere as well as its lifetime. In the present study, average multiplicators are used to link activities with greenhouse gas emissions. These multiplicators allow the conversion of, for instance, the consumption of 100 kWh of electricity to the corresponding amount of CO_2e.

System boundaries

The data should, if possible, originate from festivals in 2022 (post-covid). As a reference, some data sets from 2019 (before the covid 19 pandemic) can also be used to get a fuller picture of the expected emissions by source. Only Swiss music festivals are considered in the present study.

Data compilation and aggregation

The data collected from the festivals are assigned to each of the three predefined festival categories and the average is calculated for each category. Averages are used to counter the lack of data or the fact that some festivals only have or want to share part of their data.

To measure the total carbon footprint of the Swiss music festival scene, the averaged data are extrapolated using the number of festivals in each category. The multiplicators for the extrapolation from averaged carbon footprint of each festival category to the total footprint of the Swiss music festival can be seen in Table 1.

Table 1: Festival categories and number of festivals in each category

Festival category	Number of festivals per year (2022)
Indoor music festivals	240
Outdoor music festivals with camping	80
Outdoor music festivals without camping	80

Development of scenarios

Based on available data and exchanges with MDE representatives, the following scenarios are calculated with the following model:

1. Mobility
    a. Status quo (cars 27%)
    b. Auto 20% (cars 20%, the rest replaced by trains)
    c. Auto 10% (cars 10%, the rest replaced by trains)
2. Food
    a. Status quo
    b. 50% less meat (50% of menus with meat replaced by menus without meat)
    c. No meat (all the menus with meats replaced by menus without meat)
3. Energy
    a. Status quo
    b. 50% less oil (50% replaced by biogas)
    c. No oil (all oil replaced by biogas)

Limitations

This research study has several limitations: the environmental impacts were only calculated with the indicator CO_2e. This indicator allows to quantify the impacts of activities on greenhouse gas emissions and thus on climate change. Impact categories like resource depletion, land use, toxicity, etc. are not considered with this method. Other types of emissions such as noise, pollution, and light were not considered in this study. In addition, only a limited number of festivals could provide relevant data. The multiplicators used in the present study are subject to a certain degree of uncertainty and could be tested with the help of a sensitivity analysis in future studies. The results of this study can be considered a good first estimate of the carbon footprint of the Swiss music festival scene. Future studies should focus on increasing the quantity and quality of the collected data.

The festival market in Switzerland

Swiss music festival scene

The calculated cumulative carbon footprint of the Swiss music festival scene amounts to approximately 128 thousand tons CO_2e for the year 2022. With the methodology applied, the footprint can be allocated to the three festival categories taken into account. Indoor music festivals are responsible for 37%, outdoor festivals without camping for 23% and outdoor festivals with camping for 40% of the total carbon footprint. It is important to note that these numbers represent the cumulative emissions per festival category (average per event * number of events per year). The comparison is therefore also impacted by the yearly number of festivals in one category.

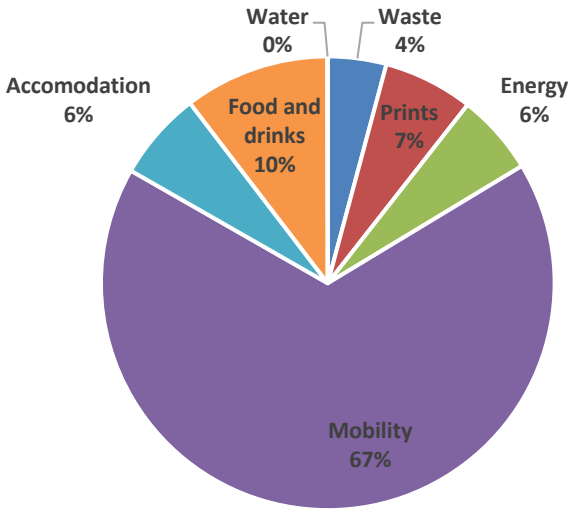

Figure 2 : Shares of each sector in the total carbon footprint of the Swiss music festival scene in 2022

Five of the seven activities considered are responsible for more than 95% of the cumulative emissions. These five categories are mobility (67%), food and beverages (10%), prints (7%), accommodation (6%) and energy (6%).

Carbon footprint by festival type (per festival)

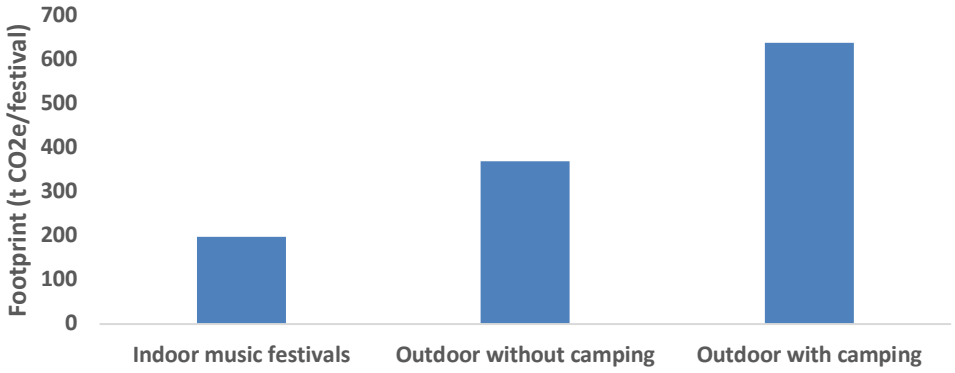

Figure 3 : Carbon footprint per festival

The indoor music festivals account for approximately 40% of the total carbon footprint of the music festival scene in Switzerland in 2022, the averaged emissions per indoor festival are smaller than those of outdoor festivals. The presence of a campground seems to have a strong impact on emissions; an average outdoor music festival with a campground has twice the environmental footprint of an outdoor music festival without a campground.

It is important to note that even though the main emission sources remain constant, differences can be observed between the festival types and between the total carbon footprint and the footprints of each individual festival type.

Even though these differences can come from real differences between the activities of each festival category, data uncertainty is likely to play a relevant role in these results as the number of datasets is small and organizers may have used different data collection methods. According to the provided data, prints are only relevant for the category "indoor music festivals".

The majority of emissions allocated to “prints” come from only one festival, which impacts the whole category as well as the footprint of the Swiss music festival scene (prints are responsible for 7% of the total CO_2e emissions). The effect of outliers would be reduced with a higher number of data provided.

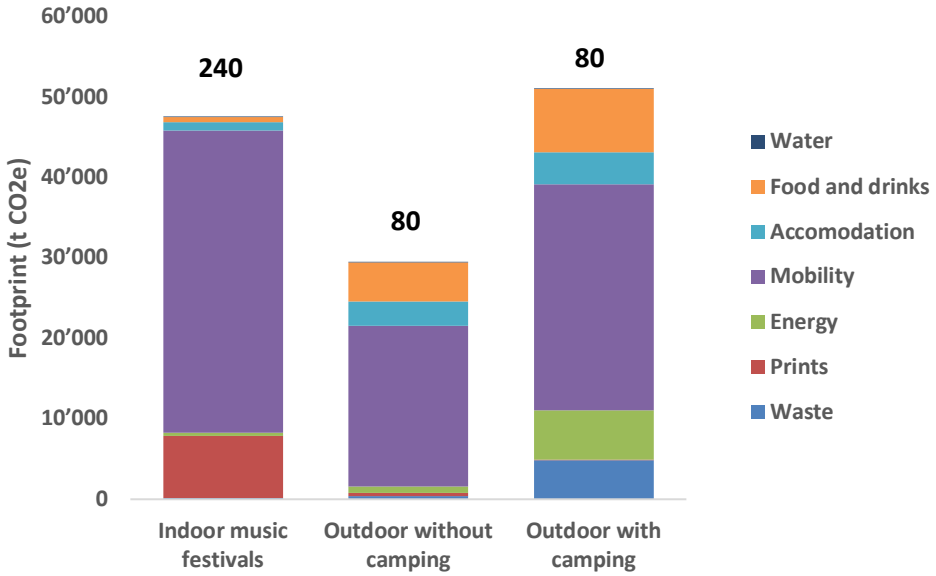

Figure 4: Carbon footprint of each festival category, extrapolation based on the total amount of festivals in each category (Bold numbers above the footprints)

The observation of Figure 3 and Figure 4 leads to the conclusion that outdoor festivals have, on average, a higher footprint than indoor festivals. However, the total carbon footprint of the Swiss music festival scene is strongly impacted by the number of festivals from each festival category.

Carbon footprint per visitor

By dividing the averaged footprints per category with the number of visitors in each category, the carbon footprint per visitor per category can be obtained. This method provides an insight into the situation in 2022. However, the results can vary significantly from one year to the next depending on the number of visitors. This effect should be further analyzed to be understood correctly, as a smaller number of visitors would theoretically lead to a higher footprint per person, but fewer visitors would also reduce the overall emissions: because for example, mobility would decrease. For the year 2022, the average footprint per visitor was 8.8 kg CO_2e/person. The personal footprint per visitor was highest for indoor music festivals. The personal footprint of outdoor festival visitors was approximately the same for festivals with and without camping.

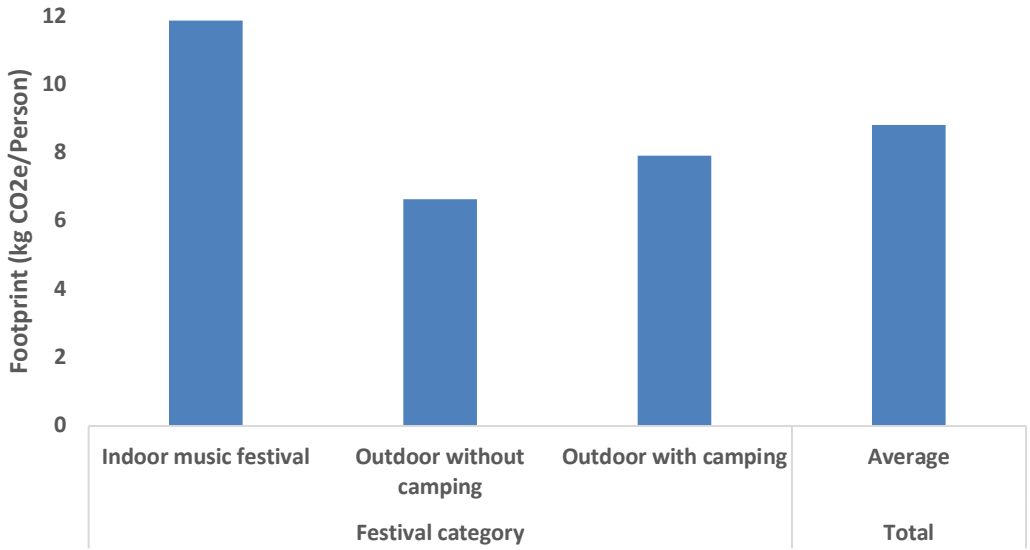

Figure 5: Carbon footprint per person in each festival category and on average

Scenario development

Scenarios were developed, based on the results and exchanges with MDE representatives. The aim of these scenarios is to understand and show the impact of different measures on the carbon footprint of music festivals. Scenarios were elaborated for mobility, food and drinks, and the energy sectors. For each sector, one plausible and one extreme scenario were modelled.

The scenarios depict a simplification of reality and leave out certain aspects. For instance, in the mobility sector, the comfort that can be associated with a mean of transportation (for instance with a private car) is not taken into account, and it is assumed that a visitor who foregoes a car will automatically take the train.

The same assumptions apply to the food and drinks sectors, where a portion with meat is replaced by a portion without meat. The assumption here is that the satiation is the same in both cases for a given visitor, and personal preferences are not considered.

Mobility scenarios

The results show that mobility accounts for the largest part of CO_2e-emissions, both for each festival category and for the music festival scene as a whole. In 2022, mobility by car and motorbike dominated the mobility sector and were responsible for 48% of the mobility emissions, even though only 27% of the visitors used this mean of transportation. The two following scenarios were developed:

- Car 20% (20% of the visitor travelled by car or bike, the remaining 7% used the train)
- Car 10% (10% of the visitor travelled by car or bike, the remaining 17% used the train)

Mobility produces approximately 85.7 thousand tons of CO_2e. This study shows that 27% of the spectators travel to the event by car; they produce 48% of the emissions related to mobility. Air traffic, mainly used by the artists, is responsible for 24% of mobility related emissions. If festival organizers managed to reduce mobility by car from 27% to 20% in favour of public transport, mobility emissions could be reduced by 9%, and the total festival emissions by 6%.

If only 10% travelled to the festivals by car, the savings would even reach 24% of the emissions related to mobility, or 16% of the total emissions. These significant savings of 20.6 thousand tons of CO_2e can be compared with the potential that one million trees can absorb in one year; this would equal to a forest of 34 square kilometers in size – nearly the territory of the Swiss canton Basel-Stadt.

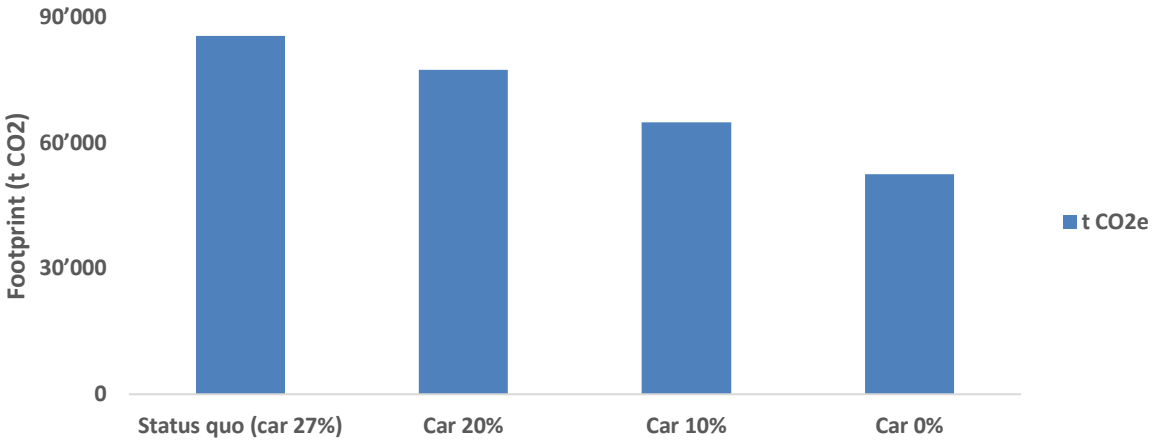

Figure 6: Carbon footprint of the different mobility scenarios

Food and drinks scenarios

The production and consumption of food and drinks at festivals accounted for 10% of the total CO_2e emissions in 2022. Food and drinks emissions were dominated by beer (34%), menus with meat (21%), menus without meat (22%), and mineral and soft drinks (18%).

The developed scenarios focus on food served at festivals and depict a situation where menus with meat are replaced with menus without meat.

- Meat 50% (50% of menus with meat are replaced with menus without meat)
- No meat (all menus with meat are replaced with menus without meat)

Food and beverages are responsible for approximately 13 thousand tons of CO_2e. Especially outdoor festivals sell large amounts of food and beverages. This is 15.8% of the emissions produced by outdoor festivals.

If festival organizers managed to replace 50% of meals by vegetarian meals, 4% of the emissions produced by food and beverages could be saved. That equals 390'000 additional vegetarian meals. If only vegetarian food options were available, 9% of food and beverages emissions could be saved, which is equivalent to the absorption potential of a forest of two square kilometres.

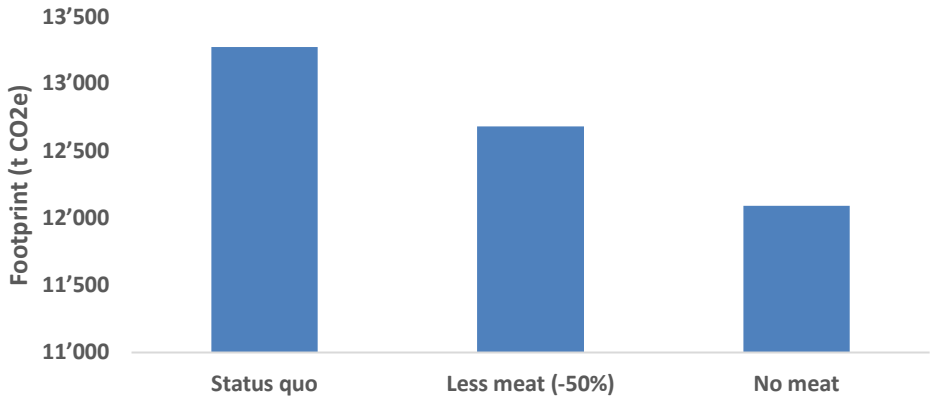

Figure 7: Carbon footprint of the different food and beverages scenarios

Energy scenarios

Energy consumption at festivals in 2022 accounted for 6% of the total CO_2e emissions. Emissions from energy consumption (and its production) were dominated by heating oil (73%) and diesel (15%).

The energy scenarios focus on heating oil and assume that it was used for heating, which could also be done with biogas. The impacts of infrastructure change that would come with the use of biogas instead of heating oil were not considered. The two scenarios are:

- Heating oil 50% (heating oil consumption reduced by 50% and replaced by biogas)
- No heating oil (heating oil consumption reduced to 0% and replaced by biogas)

Energy use is responsible for 7.4 thousand tons of CO_2e. If festival organizers were to replace 50% of oil heating systems with biogas, 22% of energy emissions could be saved. If oil heating systems were completely replaced by biogas, savings of even 44% of energy CO_2e emissions could be achieved. These savings correspond to the annual emissions for heating 800 households with a modern biogas system.

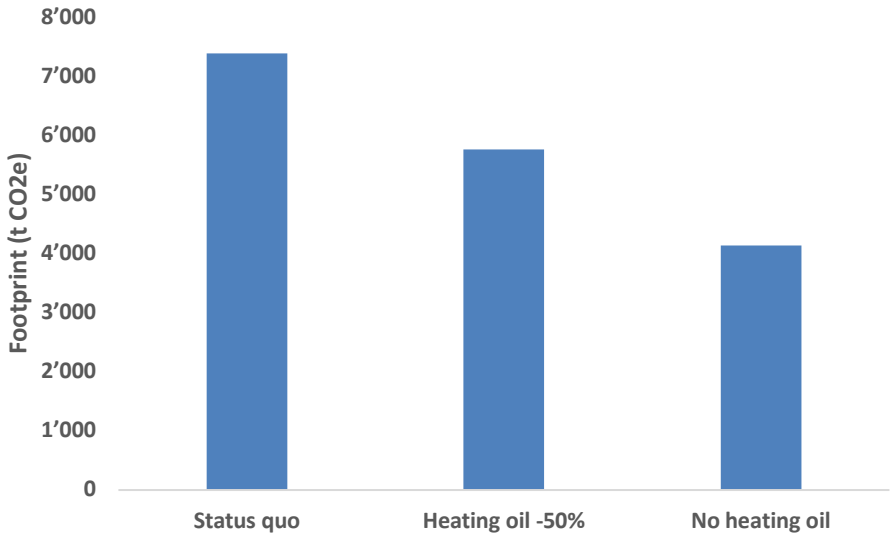

Figure 8: Carbon footprint of the energy scenarios

Combined scenarios

Measures to reduce the carbon footprint can be combined to increase the total impact. The considered measures can be developed simultaneously, assuming that there is no rebound effect. A rebound effect would for instance imply that incentives to reduce transportation by car would lead to an increase of people ordering meat-based meals, considering that they have already done something positive for the environment.

The three combined scenarios are:

- Combi 1: Heating oil reduced by 50%, meat consumption reduced by 50%, 20% of the visitors travel by car, material printed is reduced by 50%
- Combi 2: No heating oil, no meat-based meals, no cars, no prints
- Combi 3: Similar to “Combi 2”, but visitors use the train instead of autocars

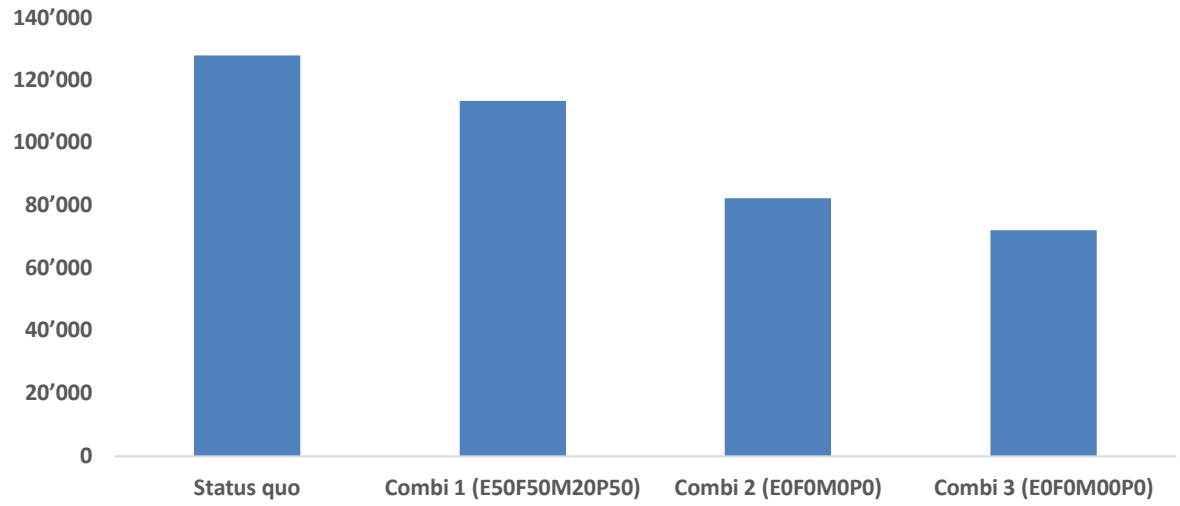

Figure 9: Carbon footprint of the combination scenarios

If all the visitors would travel with public transports, the festivals would only offer vegetarian meals, would have no print material and would replace heating oil with biogas, the total carbon footprint of the Swiss music festivals would be reduced by 44% compared to 2022.

Conclusion

Results

In this study, the carbon footprint of music festivals in Switzerland was calculated. At the Swiss scale, the activities responsible for 95% of emissions are mobility, food and beverages, prints, accommodation, and energy. The results show that visitor mobility is the largest contributor to the emissions, for each festival category and even when emissions are allocated per visitor or per event day. Indoor music festivals have the smallest impact per event, but account for half of total emissions, as the yearly number of indoor festivals is more than 40% higher than that of outdoor events.

Scenarios

The scenarios show the consequences that certain restrictions or policies could have on the carbon footprint of the Swiss music festival scene. To better understand the consequences and to optimize new restrictions, policies and management decisions, further analyses are needed for each festival category. On top of that, the combination of different scenarios should also be considered and investigated.

Limitations

As mentioned above, only a limited amount of data could be collected. The results are considered a good first estimate of the carbon footprint of the Swiss music festival scene. Future studies should focus on increasing the quantity and quality of the collected data. The multiplicators used in the present study are also subject to a certain degree of uncertainty and could be tested in future studies with the help of a sensitivity analysis.

Facts and multipliers for calculation

- On average, a tree absorbs about 20 kg of CO_2 per year.
- Average CO_2e emissions per person in Switzerland are around 5 tons per year (excluding emissions from imported goods).
- An electric car emits about 89 grams of CO_2e per kilometre driven.
- A meal with meat emits about 2.3kg CO_2e, the meatless alternative about 1.5kg CO_2e.
- One hectare of forest "stores" about 6 tons of CO_2e per year across all age classes.
- A natural gas heating system produces about 4 tons of CO_2 per year.

Appendix

Mobility

Table 2: Mobility scenarios

	Mobility	Reduction mobility		Reduction total
Scenarios mobility	**t CO_2e**	**t CO_2e**	**%**	**%**
Status quo (car 27%)	85'732	0.00	0	0
Car 20%	77'596	-8'136	-9	-6
Car 10%	65'120	-20'613	-24	-16
Car 0%	52'643	-33'089	-39	-26
Only public transports	42'506	-43'227	-50	-34

Food and beverages

Table 3: Food and beverages scenarios

	Food and drinks	Reduction food and drinks		Reduction total
Scenarios food and drinks	**t CO_2e**	**t CO_2e**	**%**	**%**
Status quo	13'280	0.00	0	0
Less meat (-50%)	12'688	-592	-4	-0.5
No meat	12'096	-1'184	-9	-0.9

Energy

Table 4: Energy scenarios

	Energy	Reduction energy		Reduction total
Scenarios energy	**t CO_2e**	**t CO_2e**	**%**	**%**
Status quo	7'395	0.00	0	0
Heating oil -50%	5'767	-1'628	-22	-1
No heating oil	4'139	-3'255	-44	-3

MUSIC DECLARES EMERGENCY SWITZERLAND

NO MUSIC ON A DEAD PLANET

A.B./MUSIC DECLARES