The carbon footprint of Way Out West 2019

Including the carbon footprints associated with Oatly's activities at the festival, and of Nöjesguiden

This report presents preliminary results for Way Out West 2019, partly based on data from 2018. Final results based on data for 2019 will be published later this year.

Maria Nordborg (maria@svalna.se)
David Andersson (david@svalna.se)

Svalna consulting report version 1.0
August 7, 2019

Abstract

Oatly, one of the main sponsors of the Way Out West festival, contacted Svalna (www.svalna.se) in June 2019, and asked Svalna to calculate the carbon footprint of Way Out West, in line with Oatly's campaign for increased carbon transparency. This report presents preliminary results for Way Out West 2019, partly based on data from 2018. Final results, based on data for 2019, will be published later this year.

The carbon footprints that Svalna have calculated include the *largest* emission sources associated with *arranging* the festival, and that Luger, the festival organizer, directly controls. Visitors' emissions associated with transportation, accommodation and consumption of food and drinks are not included. The system boundaries were defined based on what is considered necessary to fulfil the *main purpose* of the festival, that is; providing paying visitors with music and other cultural events on the festival grounds. Emissions associated with sponsors, and with provision of food and drinks, were therefore excluded from the assessment.

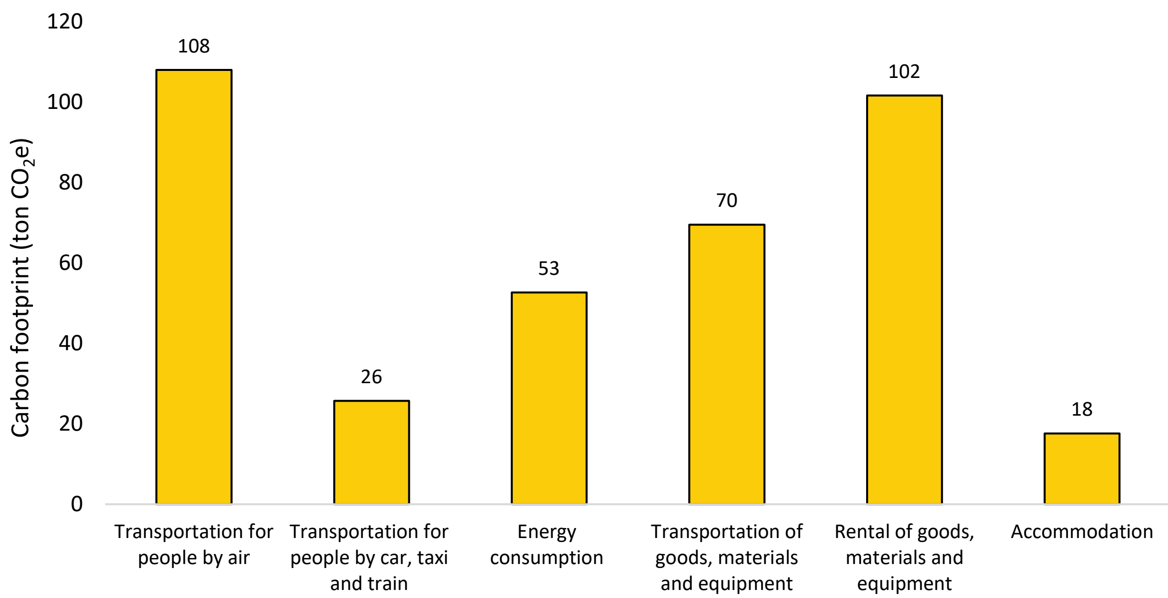

Figure 1 The carbon footprints of separate parts of Way Out West 2019 (preliminary results).

Emission factors for different materials, products and activities were obtained from life cycle assessments, and from so-called "environmentally extended input output analyses" by Statistics Sweden. The results are presented in emissions of greenhouse gases in carbon dioxide equivalents (CO_2e), associated with different objects and activities at and around Way Out West, and for the entire festival.

The project consists of three parts. In part 1, Svalna estimated the carbon footprint associated with *arranging* the festival, in the areas of transporting people and goods to and from the festival, renting equipment, material and goods required to arrange the festival, accommodating artists and Luger employees, and consumption of energy. Svalna also calculated the carbon footprints of the following specific objects: portable vacuum toilets, mobile phone charging and the main stage (only energy consumption).

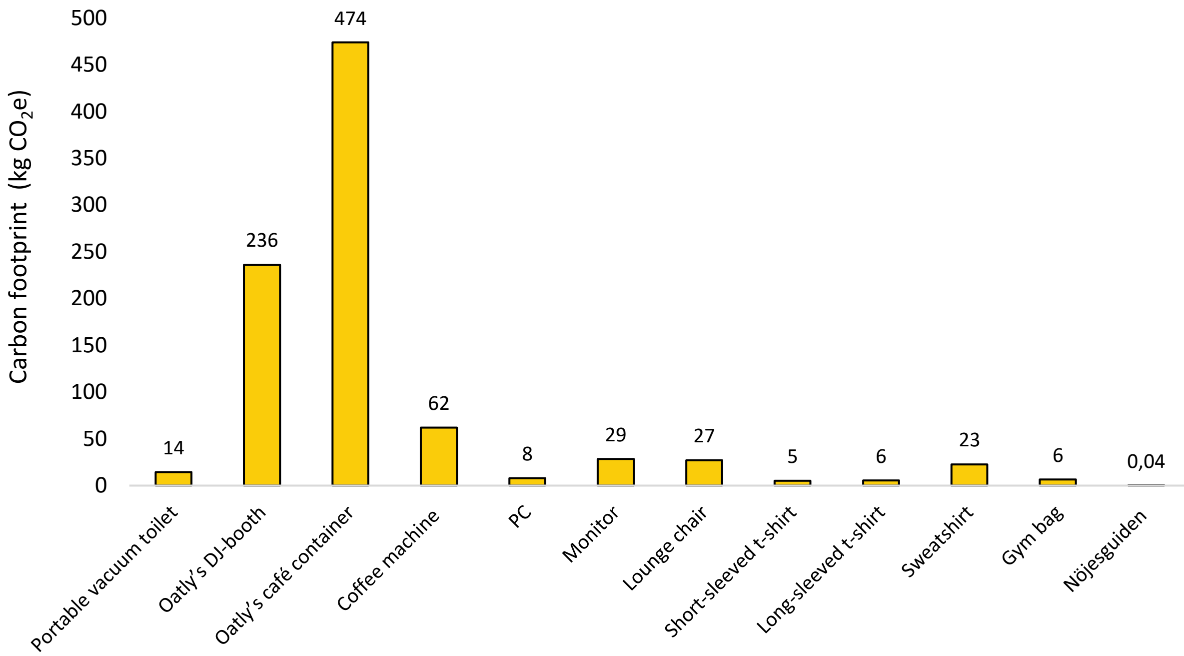

Figure 2 The carbon footprints of specific objects at Way Out West 2019 (preliminary results). The results are expressed per singular item, during Way Out West. The carbon footprints of charging a mobile phone and of the main stage were also assessed but not included in this figure due to significantly smaller (1,3 g CO_2e) and larger (23,8 ton CO_2e) footprints, respectively.

The carbon footprint of Way Out West 2019 is estimated to 375 ton CO_2e. The largest emission sources are air travel (29% of the total), rental of goods, materials and equipment (27% of the total), and transportation of goods, materials and equipment (19% of the total), see Figure 1. The carbon footprints per ticket are estimated to 4,6 and 13,8 kg CO_2e for one- and three-day tickets, respectively. These values should be interpreted as the greenhouse gas emissions "caused" by buying a ticket, based on what is included in the price for a ticket (food and drinks are for example not included, hence not included in the carbon footprint of a ticket).

In part 2, Svalna calculated the carbon footprints of specific objects and/or activities that are specifically associated with Oatly's presence at the festival, namely: Oatly's DJ-booth, café container, coffee machine, PC, monitor, lounge chairs, staff clothes and gym bags, see Figure 2. In part 3, Svalna calculated the carbon footprint of Nöjesguiden (also included in Figure 2).

The results presented here should be considered uncertain, mainly due to difficulties obtaining data, and the many assumptions we had to do to make up for lack of data. Many key parameters are associated with large uncertainties, for example number of sold tickets, life length of different objects, transport distances, and the weight of goods and materials. It is also important to remember that the carbon footprints calculated here do not include *all* emissions, although we have tried to include *the most important* ones. The results should therefore be interpreted with some caution. No qualitative assessment of the uncertainties has been done.

Despite limitations and uncertainties, this assessment is an important step forward towards greater climate transparency of festivals (and cultural events in general), and towards higher climate literacy among people. Better carbon footprint estimates mainly require more detailed information about where artists fly from, weight and transport distances for the most important goods and materials, and more information about the goods, materials and equipment that Luger rents.

A future assessment with a wider scope could potentially also include the emissions from transportation of food and drinks, as well as the energy used by food stall, bars and sponsors. In that case, the emissions associated with transportation and accommodation of bar staff and sponsors should be included as well, in order to maintain consistent system boundaries.

Table of content

Background

Oatly, one of the main sponsors of Way Out West, contacted Svalna in June 2019, and asked Svalna to calculate the carbon footprint of Way Out West, in order to increase its carbon transparency, in line with Oatly's campaign for increased transparency[1]. By showing visitors the carbon footprints of specific objects and/or activities at and around the festival, and providing information about how the numbers were calculated (i.e., this report), Oatly and Luger want to contribute to increasing the carbon literacy among visitors, and encourage other companies and event organizers to become climate transparent as well, by showing their numbers.

Luger, the organizer of the festival, also became involved in the project at an early state, and agreed to provide the necessary data. Another company, CarbonCloud, was hired to calculate the carbon footprints of the food and drinks served at the festival.

This report presents preliminary results for Way Out West 2019, partly based on data from 2018. Final results, based on data for 2019, will be published later this year.

System boundaries

The system boundaries define which emissions are included in the assessment, and which emissions are excluded. Svalna's ambition has been to include the *largest* emission sources associated with *arranging* the festival, and that Luger, the festival organizer, is directly responsible for, or controls. Specifically, the assessment includes the emissions associated with:

1) Transportation for artists and Luger employees to and from the festival, by airplane, car, taxi and train.
2) Accommodation for artists and Luger employees in association with the festival.
3) Energy consumption associated with arranging concerts and other cultural events on the festival grounds.
4) Transportation of goods, material and equipment required to arrange the festival.
5) Rental of goods and equipment required to arrange the festival.

The "festival grounds" are defined as the areas called Flamingo (the main stage), Azalea (the second largest stage), Linné, Dungen, and Höjden. Emissions from energy use associated with arranging concerts and other events at Bananpiren and Stay out West are not included.

The system boundaries were defined based on what is considered necessary to *fulfil the purpose* of the festival, and that Luger, the organizer, to some degree can control. The purpose of the festival is to provide paying visitors with music and other cultural events on the festival grounds. The largest emission sources associated with this purpose were therefore included in the assessment.

[1] Read more about Oatly's work with calculating and communicating the carbon footprints of their products here: https://www.oatly.com/uk/climate-footprint

Many companies, “sponsors”, support and participate at the festival. These companies typically have a tent, staff members that visitors can talk to, and they carry out different activities on the festival grounds. All emissions associated with sponsors were excluded from the assessment, for practical as well as logical reasons. It would have been very difficult to obtain the required data with short notice during the summer holidays, and sponsors are not considered strongly associated with the main purpose of the festival. Sponsors and their activities should rather be understood as marketing activities aimed at the festival visitors, and their emissions should not burden visitors.

Emissions associated with the provision of food and drinks were also excluded from the assessment, since eating and drinking is not considered a main purpose of the festival, as reflected by the fact that it is not included in the price for a ticket (the carbon footprints of the food and drinks served at the festival have however been calculated in a separate assessment by CarbonCloud).

In addition, emissions from the following sources and activities were excluded from the assessment:

- Use of electricity at Luger's office, and other emissions associated with activities at Luger's offices.
- Transportation of food and drinks to and from the festival.
- Purchase and rental of services such as cleaning, catering, communication and internet, and rental of land and buildings on the festival grounds.
- Transportation, accommodation and consumption of food and drinks of visitors.
- Concerts and other events at Bananpiren, and at Stay out West (i.e., at clubs around Göteborg).

We acknowledge that it is tricky and far from straightforward to define the system boundaries; it could be done based on boundaries in time and space, and/or based on what is included in the price of a ticket. To illustrate the challenges associated with defining the system boundaries, consider the provision of food and drinks. While it is not included in the ticket, and partly out of Luger’s control, all food stalls and bars do have permission to sell food and drinks, and they have to comply with Luger’s decision to only sell vegetarian food. Luger also makes sure that the food stalls and bars have the power they need, and one may argue that food and drinks is in fact an important part of going to a festival. A future assessment with a wider scope could potentially also include the emissions associated with sponsors, food stalls and bars.

Method

The carbon footprints calculated here represent the emissions of greenhouse gases in carbon dioxide equivalents associated with different objects and activities. What is included in each carbon footprint differs between objects and activities, depending on relevance. Our aim has been to capture as much as possible of the largest emissions.

Emission factors for different materials, products or activities were derived from life cycle assessment studies, or from so-called “environmentally extended input output analyses” by Statistics Sweden. Emission factors from Statistics Sweden are expressed on the form g CO_2e/SEK and were used to estimate the emissions based on financial data; this method was used to estimate the emissions associated with rental of goods, materials and equipment, and transportation for people by car, taxi and train. All other emissions were estimated based on physical data.

Transport-related emissions, for example, were estimated based on the weight of the transported goods, the transport distance, the energy consumption associated with heavy trucking, and the emission intensity of road transport diesel consumption.

All results are reported in g, kg or ton of carbon dioxide equivalents (CO_2e). This is the standardized way of expressing the global warming potential of different greenhouse gases on a common scale.

Production-related emissions were in most cases allocated to Way Out West 2019 based on the estimated total service hours of the studied object, and the hours of use during Way Out West 2019. If, for example, a specific object is used for 36 hours during the festival, and used for 3600 hours in total during its lifetime, 1% of the total greenhouse gas emissions associated with production would be allocated to Way Out West 2019.

Part 1: The carbon footprint of Way Out West 2019

In part 1, Svalna assessed the largest sources of greenhouse gas emissions associated with *arranging* the festival, in the areas of transporting people and goods to and from the festival, renting equipment, material and goods required to arrange the festival, accommodating artists and Luger employees during the festival, and energy consumption associated with arranging concerts and other cultural events on the festival grounds.

Svalna also calculated the carbon footprints of the following specific objects: portable vacuum toilets, mobile phone charging and the main stage.

Transportation for people by air

Method and data

Svalna estimated the greenhouse gas emissions from air travel using the information in Tables 1 and 2, and an emission factor of 170 g CO_2e/person/km, as suggested by Kamb & Larsson (2019). We used the same emission factor for all flights since the increase in emissions due to take off for short haul flights is approximately the same as the increase due to non-CO_2 effects for long haul flights, according to Kamb & Larsson (2019).

Table 1 Flight distances from selected cities in different regions, and average flight distances used for calculating the carbon footprints of air travel in association with Way Out West 2019.

Region	Departure / arrival	Flight distance to Göteborg (km)
Nordic countries	Umeå	815
	Stockholm	397
	Oslo	255
	Helsinki	791
	Reykjavik	1769
	Average	**805**
Europe	Berlin	584
	Paris	1171
	Budapest	1230
	Madrid	2225
	London (3 times higher probability)	1038
	Rome	1760
	Average	**1261**
USA	Manhattan	6000
	Kansas City	7290
	San Francisco	8580
	Average	**7290**

Detailed information about the flights for artists and Luger employees were not available at the time of this assessment. The underlying flight data should therefore be considered uncertain, best estimates. Flights were divided into three regions: Nordic countries, Europe and USA, and we assumed that the flights departed from a selection of geographically representative cities with equal probability, see Table 1. An exception was made for Europe, since many artists performing at Way Out West 2019 come from Great Britain. London was therefore given three times higher probability than the other cities in Europe.

Flights with an intermediate landing were assumed to be 30% longer, and business class flights were assumed to have a 50% higher emission factor, than economy class tickets. We included the emissions from flight both to and from Way Out West for all artists and Luger employees (artists are responsible for almost all flights).

Table 2 Underlying flight data used for calculating the carbon footprints of air travel in association with Way Out West 2019.

Departure (region/city)	Number of intermediate landings	Arrival (region/city)	Number of flights	Class
Göteborg	0	Europe	25	Economy
Europe	0	Göteborg	25	Economy
Göteborg	0	Nordic countries	25	Economy
Nordic countries	0	Göteborg	25	Economy
Göteborg	1	Europe	30	Economy
Europe	1	Göteborg	30	Economy
Göteborg	0	Europe	20	Business
Europe	0	Göteborg	20	Business
Göteborg	0	USA	10	Business
USA	0	Göteborg	10	Business
Göteborg	1	USA	5	Business
USA	1	Göteborg	5	Business

Results

The carbon footprint of transporting people by air is estimated to 108 ton CO_2e. This value represents the emissions of greenhouse gases in carbon dioxide equivalents associated with transporting artists and Luger employees by air, in association with Way Out West 2019.

Due to the large uncertainties in the underlying flight data, and the many assumptions we had to do to make up for lack of data, this result should be considered highly uncertain. More information about the departure cities would be required in order to provide a better estimate.

Transportation for people by car, taxi and train

Method and data

Svalna estimated the greenhouse gas emissions associated with transporting people by car, taxi and train based on how much money Luger spent on transporting artists and Luger employees by car, taxi and train, respectively, in association with Way Out West 2018. The carbon footprints were calculated by multiplying the money Luger spent on each transport mode, with corresponding emission factors from Statistics Sweden (g CO_2e/SEK). The underlying data are not presented here due to financial confidentiality.

The cars used for transporting artists and Luger employees are hired by Luger: the cost includes the car itself, as well as the service of driving, and can therefore be considered a taxi-service. We therefore used the same emission factor for transportation by car, as we did for taxi. In addition to the costs associated with transporting people by car, taxi and train, some transport costs were uncategorized, i.e., the means of transport was not known. Those transports were also included, by using an emission factor from Statistics Sweden that represents "*Other transport services, e.g., moving*".

Results

The carbon footprint of transporting people by car, taxi and train is estimated to 25,7 ton CO_2e, of which car transport is responsible for more than two thirds, see Table 3. The carbon footprints represent the emissions of greenhouse gases in carbon dioxide equivalents associated with transporting artists and Luger employees by car, taxi, train and other (unknown) means of transport, in association with Way Out West 2019. The result is based on financial data from 2018, and used as a preliminary result for 2019, before data for 2019 becomes available.

Table 3 The carbon footprints of transporting artists and Luger employees by car, taxi, train and other (unknown) means of transport, in association with Way Out West 2019.

	Carbon footprint (ton CO_2e)
Car	19,5
Taxi	2,2
Train	1,4
Others	2,7
Sum	**25,7**

Energy consumption

Method and data

Energy consumption refers to electricity used on the festival site, of which approximately one quarter comes from the electricity grid, and three quarters is generated on the site, in diesel generators powered with EcoPar A; an extra clean type of diesel made from natural gas, that generates lower emissions of hazardous substances, such as nitrogen oxides, and lower emissions of carbon dioxide, than ordinary diesel (www.ecopar.se).

Data on the total electricity consumption for the entire festival, and for separate activates/areas, and the fraction of electricity obtained from diesel generators and from the grid, were obtained from Luger and used as a basis for the calculations. The electricity used by food stalls, bars and sponsors were excluded from the assessment, see “System boundaries”.

Data from Luger showed that 42 550 kWh of electricity was obtained from on-site diesel generators in 2018. We estimated the amount of diesel (EcoPar A) required to provide that amount of electricity, based on the conversion efficiencies of diesel generators, differentiating between diesel generators used to provide power for concerts, and other diesel generators, see Appendix 1. The greenhouse gas emissions from diesel consumption were calculated by multiplying the consumed amount of diesel (EcoPar A) by the emission factor for EcoPar A used in on-site diesel generators, see Table 4.

The greenhouse gas emissions associated with consumption of grid electricity was estimated based on consumption data from 2018, and the average emission intensity of grid electricity in the Nordic countries, see Table 4.

Table 4 Data and information used for calculating the carbon footprints of energy consumption, and the resulting carbon footprints. The energy used by food stall, bars and sponsors is not included.

	Value	**Unit**	**Source**
Consumption of electricity from the grid. Data from Way Out West 2018	6 103	kWh	Calculated based on data from Luger
Consumption of diesel (EcoPar A). Data from Way Out West 2018	18 878 [a]	liter	Calculated based on data from Luger and J. Nilsson, pers. comm. (2019)
Emission factor for grid electricity (average electricity mix in the Nordic countries)	125,5 [b]	g CO_2e/kWh	Table 2 in Martinsson et al. (2012)
Emission factor for diesel (EcoPar A) used in on-site diesel generators	72,4 [b]	g CO_2e/MJ	Calculated based on info in ICF (2012)
Carbon footprint associated with consumption of grid electricity	0,8	ton CO_2e	Calculated by Svalna
Carbon footprint associated with consumption of diesel (EcoPar A) on the festival grounds	51,9	ton CO_2e	Calculated by Svalna
Total carbon footprint associated with energy consumption (electricity + diesel)	52,7	ton CO_2e	Calculated by Svalna

[a] With 38 MJ/liter (J. Nilsson, pers. comm., 2019), 18 878 liters of EcoPar A contains 717 GJ of energy.
[b] For more info, see Appendix 2.

Results

The carbon footprint of energy consumption is estimated to 52,7 ton CO_2e, see Table 4. The carbon footprint represents the emissions of greenhouse gases in carbon dioxide equivalents associated with energy use on the festival grounds, excluding the energy used by sponsors, food stalls and bars. The result is based on energy consumption data from 2018, and used as a preliminary result for 2019, before data for 2019 becomes available.

Transportation of goods, materials and equipment

Method and data

The greenhouse gas emissions associated with transporting goods, materials and equipment were estimated based data in Table 5 on the weight of the transported goods, the transport distances, the energy consumption associated with heavy trucking in Sweden (1,5 MJ/ton/km[2]), and the emission intensity of diesel consumption for road transport (79,3 g CO_2e/MJ; see Appendix 2).

Due to the limited scope of this assessment, it was not possible to include the transportation of all goods required to arrange the festival. Instead, we made a selection based on weight and transport distance, since heavy goods transported long distances cause the largest transport-related emissions.

Information about the weights and location of goods, materials and equipment before and after the festival were obtained from Luger, and from collaborating partners. Transport distances were obtained from Google Maps. For goods that were transported to another festival or event directly after Way Out West, only the emissions from a one-way transport to Way Out West were included in the assessment. For equipment that was returned to its "base station" after Way Out West, the emissions from transportation both ways were included in the assessment.

Results

The carbon footprint associated with transportation of goods, materials and equipment is estimated to 70 ton CO_2e, see Table 5. This value represents the emissions of greenhouse gases in carbon dioxide equivalents associated with transporting goods, materials and equipment to and from Way Out West 2019.

Due to difficulties obtaining data, especially with regard to weights and transport distances, and the many assumptions we had to do to make up for lack of data, this result should be considered highly uncertain. In order to provide a better estimate, it would be desirable to 1) review the selection of goods, materials and equipment to include in the assessment, and 2) collect more detailed information about weights and transport distances.

[2] Only for portable plastic toilets, "Bajamajor", did we use another emission factor; 2,5 MJ/ton/km (our own estimate), since portable plastic toilets take up much space, but have a rather low weight, which can be expected to increase the energy consumption associated with road transport, since more trucks are needed.

Table 5 Information and data for calculating the carbon footprint associated with transportation of goods, materials and equipment in association with Way Out West 2019, and the resulting carbon footprint.

Type of goods	Weight (ton)	Total transport distance (km)	Origin, and information about transport distance	Emissions (ton CO_2e)
Arena panels, floors, fences etc.	72	1136 [a]	From Helsinki, one way	9,7
Arena panels, floors, fences etc.	72	943 [a]	From Warsaw, one way	8,1
Arena panels, floors, fences etc.	72	1076 [a]	From Cologne, one way	9,2
Arena panels, floors, fences etc.	72	315 [a]	From Copenhagen, one way	2,7
Arena panels, floors, fences etc.	72	469 [a]	From Stockholm, one way	4,0
Arena panels, floors, fences etc.	72	298 [a]	From Oslo, one way	2,6
Main stage	150	298	From Oslo, one way	5,3
Fences and tents	140	526	From Arvika, two ways	8,8
Circus tent	30	3090	From Peterborough, UK, two ways	11,0
Fork-lift trucks	100	30	From Hisingen, two ways	0,4
Light and sound systems	80 [c]	450 [b]	Not known	4,3
Golf buggies	5 [d]	30	From Hisingen, two ways	0,0
Golf buggies	5 [d]	938	From Stockholm, two ways	0,6
Monitors	40	60	From Kungälv, two ways	0,3
Portable toilets, "Bajamajor"	16	191	From Vänersborg, two ways	0,4
Portable vacuum toilets	50	191	From Vänersborg, two ways	1,9
Water-flushed toilets	18	191	From Vänersborg, two ways	0,4
Total carbon footprint for transportation of goods, materials and equipment (ton CO_2e)				**70**

[a] We assumed that one sixth of the total weight of arena panels, floors, fences etc. (432 ton) was transported from either one of six different plausible locations, based on information from a collaborating partner to Luger. Only emissions from a one-way transport was included due to high demand of these goods during the festival season.
[b] Own estimate, due to lack of data.
[c] Own estimate based on the weight of light and sound system for the main stage (40 ton).
[d] We assumed that 50% of the golf buggies came from Hisingen, and 50% from Stockholm (based on the weight).

Rental of goods, materials and equipment

Method and data

Luger rents most of the goods, materials and equipment required to arrange the festival. Svalna estimated the greenhouse gas emissions associated with rental of goods, materials and equipment based on how much money Luger spent on rental, in association with Way Out West 2018, and corresponding emission factors (g CO_2e/SEK) from Statistics Sweden (2019).

Based on detailed analysis of Luger's financial data from 2018 (not presented here due to confidentiality), Svalna estimated that Luger's rental costs corresponded to approximately 50% of Luger's total costs associated with arranging the festival (excl. costs for hiring artists). The other half are costs associated with transportation of people, goods, materials and equipment, cleaning services, accommodation, energy, land rental and communication services.

Results

The carbon footprint associated with rental of goods, materials and equipment is estimated to 102 ton CO_2e. This result is associated with larger uncertainties for three reasons. First, the amount of money that Luger spent on renting goods, materials and equipment is very uncertain, partly due to inherent difficulties in separating rental costs from other costs such as transport, cleaning services and other services. In most cases, Luger buys complete services where all costs, e.g., associated with renting equipment, transport and other related services such as cleaning, installation and mounting, are lumped together.

Second, Statistics Sweden only provides one matching emission factor, which represents rental of advanced technical music-, photo- and IT equipment, while a large share of the rented equipment is not technically advanced (tents, stage materials, fences, etc).

Third, the emission factor from Statistics Sweden represents the emissions caused when private consumers rent equipment from companies. It is not known how well this emission factor represents the emissions caused when a (large) company rents equipment from other companies.

Accommodation

Method and data

The carbon footprint of accommodation is based on the number of overnight stays that Luger paid for in association with Way Out West 2018, for artists and Luger employees, respectively.

Table 6 Information and data used for calculating the carbon footprints associated with accommodation, and the resulting carbon footprints.

	Artists	**Luger employees**	**Source**
Number of overnight stays in association with Way Out West (data from 2018)	960	240	Luger
Emission factors for hotel accommodation (kg CO_2e/night in a hotel room)	15,5 [a]	11,2	Svalna's estimates based on data in Moberg et al. (2016) and the Swedish Energy Agency (2011)
Carbon footprint for accommodation for artists and employees, resp. (ton CO_2e)	14,9	2,7	Calculated by Svalna
Total carbon footprint for accommodation for artists and Luger employees (ton CO_2e)	17,6		Calculated by Svalna

[a] The emission factor for a double room was estimated by increasing the emissions associated with heating and hot water, electricity use and laundry by 50%. All other emissions, i.e., those associated with cleaning and breakfast, were assumed to be the same as for a single room.

Svalna calculated the carbon footprint associated with accommodation by multiplying the number of overnight stays for artists and Luger employees, respectively, with the corresponding emission factors for hotel accommodation, see Table 6. We assumed that artists stay in double rooms, and that Luger employees stay in single rooms, and calculated emission factors for artists and employees based on information in Moberg et al. (2016) and the Swedish Energy Agency (2011). The emission factors include emissions from heating and hot water, electricity, cleaning, breakfast, laundry, room maintenance, etc. (construction and maintenance of the hotel building itself is not included).

Results

The carbon footprint of accommodation is estimated to 17,6 ton CO_2e, of which artists are responsible for 85%, and Luger employees are responsible for 15%, see Table 6. The carbon footprint is an estimate of the total emissions of greenhouse gases in carbon dioxide equivalents associated with accommodating artists and Luger employees in association with Way Out West 2019. The result is based on data from 2018, and used as a preliminary result for 2019, before data for 2019 becomes available.

The carbon footprint of the entire festival and per ticket

The carbon footprint of Way Out West 2019 is estimated to 375 ton CO_2e, see Table 7. This value is the sum of the individual parts, i.e., the carbon footprints associated with transporting and accommodating artists and Luger employees before, during and after the festival, renting and transporting goods, materials and equipment, and the consumption of energy associated with arranging concerts and other cultural events on the festival grounds.

Table 7 The total carbon footprint of the entire festival, and of separate parts. Preliminary results for Way Out West 2019, partly based on data from 2018. Note that values may not add up due to rounding errors.

	Carbon footprint of Way Out West 2019 (ton CO_2e)	**Percentage of total**
Transportation for people by air travel	108	29%
Transportation for people by car, taxi and train	26	7%
Energy consumption	53	14%
Transportation of goods, materials and equipment	70	19%
Rental of goods, materials and equipment	102	27%
Accommodation	18	5%
The total carbon footprint of the entire festival (the sum of all individual parts)	**375**	**100%**

The carbon footprints per ticket are estimated to 4,6 and 13,8 kg CO_2e for one- and three-day tickets, respectively (Table 8). These values should be interpreted as the greenhouse gas emissions “caused” by buying a ticket, based on what is included in the price for a ticket.

Table 8 The carbon footprints for different type of tickets. Preliminary results for Way Out West 2019.

Type of ticket	**Estimated number of sold tickets in 2019**	**Corresponding number of sold “ticket-days”**	**The carbon footprint per ticket (kg CO_2e)**
1-day ticket	11 667 [a]	11 667	**4,6**
3-day ticket (festival pass)	23 333 [a]	70 000	**13,8**
	Total number of sold “ticket-days”:	81 667	

[a] It was estimated that 35 000 tickets were sold in total, of which one third were day tickets and two thirds were three-day tickets.

The carbon footprints per ticket were calculated based on the estimated number of sold tickets in 2019, see Table 8. Based on the estimated number of sold tickets per ticket category, we calculated how many “ticket-days” were sold in total, counting one-day tickets as one, and three-day tickets as three. Then, we calculated the carbon footprint of a day-ticket as the total carbon footprint of the entire festival (375 ton

CO_2e) divided by the total number of sold “ticket-days”. The carbon footprint of a three-day ticket was then calculated as three times the carbon footprint of a day-ticket. The results in Table 8 should be considered preliminary, since tickets are still being sold at the time of this calculation.

Specific objects

Portable vacuum toilet

Method and data

Three type of toilets are used at Way Out West: traditional stand-alone portable toilets mostly made of plastic (“bajamajor”), portable vacuum toilets, and water-flushed toilets. Svalna calculated the carbon footprint of a portable vacuum toilet, using the data in Table 9. Data about the toilets were obtained from Luger, Several AB (the company from which Luger rents the toilets) and from Jets, the manufacturer. The assessment includes the emissions of greenhouse gases associated with production, energy use, transport and consumption of paper and soap associated with using the toilet. Greenhouse gas emissions associated with waste management were not included.

The greenhouse gas emissions associated with production were estimated to 609 kg CO_2e per toilet, based on the weight of constituent materials, and the emission factors in Table 9. The emission factors capture the emissions associated with production and refinement of the constituent materials. Emissions associated with raw material mining and assembly are not included, but can be considered negligible in comparison.

The production-related emissions were allocated to Way Out West 2019 based on the estimated total service hours of the toilet, and the hours of use during Way Out West 2019. Svalna estimated that the toilets are used on average 120 days per year, for 10 years in total. Three days of use at Way Out West 2019 therefore represents 0,3% of the total lifetime service hours, and an equally large share of the carbon footprint associated with production was allocated to Way Out West 2019.

Energy use includes the electricity used to provide light in the toilet, and the electricity required to flush the toilet. First, we first estimated how much electricity one toilet uses during the entire festival, assuming that a 10 W lamp provides light for 12 hours per day, and that each toilet is flushed on average once every five minutes for 12 hours per day, during the whole festival (36 hours). Electricity from the grid is used. The greenhouse gas emissions associated with electricity use were calculated as the total electricity consumption per toilet, multiplied by the emission intensity of grid electricity, see Table 9.

The greenhouse gas emissions associated with transportation were calculated based on the weight, the transport distance, the energy consumption associated with heavy trucking in Sweden, and the emission intensity of diesel consumption for road transport, see Table 9. Emissions from transportation both to and from Way Out West were included.

Table 9 Information and data about the portable vacuum toilets used for calculating the carbon footprint.

	Value/information	Unit	Source
Production			
Weight	250	kg	Several AB
Estimated total days in service during its lifetime	1200 [a]	days	Own estimate
Materials	Iron, glass fiber, plastic, porcelain		Several AB & Jets
Material share, iron	70%		Own estimate based on info from Several AB
Material share, glass fiber	15%		Own estimate based on info from Several AB
Material share, plastic	5%		Own estimate based on info from Several AB
Material share, porcelain	10%		Jets
Emission factor for iron production	2,3 [b]	kg CO_2e/kg	Svalna
Emission factor for glass fiber production	3,8	kg CO_2e/kg	Svalna
Emission factor for plastic production	2,5 [c]	kg CO_2e/kg	Svalna
Emission factor for porcelain production	1,3 [d]	kg CO_2e/kg	Svalna
Fraction of production-related emissions allocated to Way Out West 2019	0,3%		Calculated by Svalna
Total carbon footprint associated with production	609	kg CO_2e/toilet	Calculated by Svalna
Consumption of paper and soap			
Emission factor for consumption of soap	15,1	g CO_2e/use	Table 12 in Koehler & Wildbolz (2009)
Emission factor for consumption of toilet paper	0,7 [e]	g CO_2e/use	Hedin (2013) and EEPN (2013)
Energy use			
Energy consumption associated with lighting one toilet during the entire festival	0,4 [f]	kWh	Calculated by Svalna
Energy consumption per flushing	3,0 [g]	Wh/flushing	Estimated based on info in HaV (2014)
Energy consumption associated with flushing one toilet during the entire festival	1,3	kWh	Calculated by Svalna
Source of electricity	100% from the grid		Luger
Emission factor for grid electricity (average electricity mix in the Nordic countries)	125,5 [h]	g CO_2e/kWh	Table 2 in Martinsson et al. (2012)
Transport			
Base station	Vänersborg		Several AB
Transport distance (Vänersborg to Göteborg)	95,6	km	Google Maps
Transport method	Truck		Several AB
Emission factor for road transport diesel consumption	79,3 [h]	g CO_2e/MJ	The Swedish Energy Agency (2018)

Energy consumption associated with road transport	1,5 [i]	MJ/ton/km	Eom et al (2012), Fig. 12
Other data			
Use rate per toilet during Way Out West	12	times/hour	Own estimate
Number of times each toilet is used during Way Out West	432 [j]	times	Own estimate

[a] Assuming a toilet is used on average 120 days per year, for 10 years.
[b] No emission factor for iron was available. Instead, we used an emission factor that represents the global average of carbon steel production from recycled and virgin material. This is considered an acceptable approximation since carbon steel mainly consists of iron.
[c] We assumed that the toilet consists of PVC plastic, and used an emission factor that represents the global average of PVC production from recycled and virgin material.
[d] No emission factor for porcelain was available. Instead, we used an emission factor that represents the global average of container glass production from recycled and virgin material.
[e] Estimated based on an average consumption of 72 cm of toilet paper per person and use of a toilet (Hedin, 2013), and emission factors for toilet paper from EEPN (2013), assuming the papers is made to 90% from recycled paper and 10% from virgin material.
[f] Calculated based on an assumed power consumption of 10 W, and 36 hours of lighting.
[g] Calculated based on an average energy consumption of 5,5 kWh/person/year for flushing, referring to vacuum toilets in permanent homes from HaV (2014). This corresponds to 3 Wh/flushing, assuming a person flushes the toilet on average five times per day.
[h] For more info, see Appendix 2.
[i] The average energy use associated with heavy trucking in Sweden in 2007.
[j] Estimated assuming each toilet is used once every five minutes (i.e., 12 times per hour), during 12 hours per day, for three days.

Results

The carbon footprint of a portable vacuum toilet is estimated to 14 kg CO_2e, of which production, consumption of paper and soap, transport and energy use is responsible for 11%, 48%, 40% and 1%, respectively, see Table 10. Note that only a small fraction of the production-related emissions was allocated to Way Out West 2019.

Table 10 The carbon footprints of portable vacuum toilets, and for separate parts.

	Carbon footprints	
	Value	**Unit**
Production-related emissions allocated to Way Out West 2019	1,5	kg CO_2e/toilet during Way Out West 2019
Energy use associated with lighting and flushing	0,2	kg CO_2e/toilet during Way Out West 2019
Emissions associated with consumption of paper and soap	6,8	kg CO_2e/toilet during Way Out West 2019
Emissions associated with transport by truck (two ways)	5,7	kg CO_2e/toilet during Way Out West 2019
The total carbon footprint for one portable vacuum toilet during Way Out West 2019	14	kg CO_2e/toilet during Way Out West 2019
The carbon footprint per use of a portable vacuum toilet	33	g CO_2e/use
The carbon footprint for all (200) portable vacuum toilets at Way Out West 2019	2,8	ton CO_2e

Each visit to a portable vacuum toilet generates an estimated 33 g of CO_2e, assuming each toilet is used 432 times during Way Out West 2019 (Table 10). The total carbon footprint for all portable vacuum toilets (200 toilets) at Way Out West 2019 is estimated to 2,8 ton CO_2e. It should be noted that this value only includes all the portable vacuum toilets: other types of toilets are used as well, but their carbon footprints were not estimated in this study.

Due to difficulties obtaining data, and the many assumptions we had to do to make up for lack of data, these results should be considered uncertain. More information and/or better estimates, e.g., regarding how many times each toilet is used per day, and constituent materials, is key in order to provide a better estimate.

Mobile charging

Method and data

Svalna calculated greenhouse gas emission associated with charging a mobile phone, using the data in Table 11. The emissions were estimated based on the power consumption of a typical 1 A USB power adapter with an output voltage of 5 V, assuming it takes 1,5 hours to charge a phone. The energy required to charge a phone was thus estimated to 7,5 Wh. In order to account for losses associated with generation of heat, we added an additional 2,5 Wh of energy to the consumption.

The mobile phone charging stations are power by electricity from the grid. The carbon footprint associated with charging a mobile phone was finally calculated as the total energy consumption per charging (10 Wh), multiplied by the emission factor for grid electricity.

Table 11 Information and data used for calculating the greenhouse gas emissions associated with charging a phone, and the resulting carbon footprint.

	Value	**Unit**	**Source**
Power consumption of a typical phone charger	5 [a]	W	Apple
Time to fully charge a phone	1,5	hours	Own assumption
Energy lost as heat	2,5	Wh	Own assumption
Source of electricity	100% from the grid		Oatly
Emission factor for grid electricity	125,5 [b]	g CO_2e/kWh	Table 2 in Martinsson et al. (2012)
Carbon footprint for charging one mobile phone	1,3	g CO_2e/charging	Calculated by Svalna

[a] For example an Apple USB power adapter with an output voltage of 5 V, and 1 A.
[b] For more information, see Appendix 2.

Result

The carbon footprint of charging a mobile phone is estimated to 1,3 g CO_2e per charging.

The main stage (Flamingo) – energy use

Method and data

Flamingo is the largest stage at Way Out West. Svalna calculated its carbon footprint using the data and information in Table 12. The assessment includes the emissions of greenhouse gases from energy use at and around the main stage, during the entire festival. Production and transportation of materials were not included in the assessment; not because it is not important, but simply due to the limited scope of this assessment.

The majority of energy used at and around the main stage is generated by on-site diesel generators, and a smaller amount is obtained from the grid. All electricity used to power light- and sound systems is generated by on-site diesel generators. Grid electricity is only used for example for printers and coffee machines used backstage.

Data on the total electricity consumption at and around the main stage during Way Out West 2018, and the fraction of electricity obtained from diesel generators and from the grid, were obtained from Luger and used as a basis for the calculations. Data from Luger showed that 18 000 kWh of electricity was obtained from on-site diesel generators in 2018. We estimated the amount of diesel (EcoPar A) required to provide that amount of electricity, based on the conversion efficiencies of diesel generators used to power the main stage, see Appendix 1. The greenhouse gas emissions from diesel consumption were calculated by multiplying the consumed amount of diesel (EcoPar A) by the emission factor for EcoPar A, see Appendix 2.

Table 12 Data and information used for calculating the carbon footprint associated with energy use at and around the main stage, and the resulting carbon footprint.

	Electricity from the grid	**Electricity from diesel generators**	**Source**
Used energy (kWh electricity)	3 173	18 000	Luger
Amount of diesel (EcoPar A) required to support use (kWh)	N/A	90 000 [a]	Calculated by Svalna
Carbon footprint of energy use (ton CO_2e)	0,4 [b]	23,4 [c]	Calculated by Svalna
Total carbon footprint (ton CO_2e)	**23,8**		**Calculated by Svalna**

[a] Calculated using 20% as the conversion efficiency of the diesel generators, see Appendix 1.
[b] Calculated using 125,5 g CO_2e/kWh as the emission factor for grid electricity, see Appendix 2.
[c] Calculated using 72,4 g CO_2e/MJ as the emission factor for EcoPar A used in on-site diesel generators, see Appendix 2.

Result

The carbon footprint of the main stage is estimated to 23,8 ton CO_2e, of which 98% is associated with on-site electricity generation, i.e., diesel use (Table 12). The carbon footprint represents the emissions of greenhouse gases in carbon dioxide equivalents associated with consumption of electricity at and around the main stage, during the entire festival. The result is based on energy consumption data from 2018, and used as a preliminary result for 2019, before data for 2019 becomes available.

Part 2: The carbon footprints associated with Oatly's activities at Way Out West

In part 2, Svalna calculated the carbon footprints of specific objects and/or activities that are specifically associated with Oatly's presence at the festival. Table 13 presents an overview of which emissions are included for each object/activity. The emissions from transportation are only included for heavy items. Detailed information about how the carbon footprints were calculated for each object/activity is presented in the sections below.

Table 13 An overview of which emissions are included for each object/activity associated with Oatly's presence at the Way Out West.

	Production	**Energy**	**Transport**
Oatly's DJ-booth	X	X	X
Oatly's café container	X	X	X
Coffee machine	X	X	
PC	X	X	
Monitor	X	X	
Lounge chairs	X		
T-shirts and sweatshirts (staff clothes)	X		
Gym bags (give-away)	X		

DJ-booth

Method and data

Svalna calculated the carbon footprint of Oatly's DJ-booth using the data and information in Table 14. The assessment includes the emissions of greenhouse gases associated with production, energy use and transport. The emissions associated with producing, transporting and using the equipment and materials inside the DJ-booth, e.g., the DJ-equipment, is not included.

The greenhouse gas emissions associated with production were estimated to 6,6 ton CO_2e, based on the weight of the container, and the emission factor for carbon steel in Table 14. The emission factor for carbon steel captures the emissions associated with production and refinement; emissions associated with raw material mining and assembly are not included, but can be considered negligible in comparison.

Oatly bought the container new in 2014, and uses it approximately 12 times per year. Svalna estimated its lifetime to 15 years, i.e., we assumed that it is going to be used 180 times in total (counting Way Out West 2019 as "one time"). An equally large share of the production-related emissions (1/180) were allocated to Way Out West 2019.

Table 14 Information and data about Oatly's DJ-booth used for calculating its carbon footprint.

	Value/information	Unit	Source
Production			
Material	Carbon steel		Oatly
Weight	2,06	ton	Oatly
Emissions factor for carbon steel production (ore-based blast furnace)	3,2	kg CO_2e/kg	Svalna
Times used per year	12	times	Oatly
Estimated years in service	15	years	Oatly
Fraction of production-related emissions allocated to Way Out West	0,6%		Calculated by Svalna
Total carbon footprint associated with production	6,6	ton CO_2e	Calculated by Svalna
Energy consumption			
Average power consumption when used (i.e., of the DJ-system)	3	kW	Oatly
Service hours during Way Out West (with average power consumption)	36	hours	Oatly
Source of electricity	100% from diesel		Oatly
Conversion efficiency of diesel generators	20%		See Appendix 1
Emission factor for diesel (EcoPar A) used in on-site diesel generators	72,4 [a]	g CO_2e/MJ	Calculated based on info in ICF (2012)
Transportation			
Base station	Landskrona		Oatly
Transport distance (Landskrona to Göteborg)	240	km	Google Maps
Transport method	Truck		Oatly
Energy consumption associated with transport	1,5 [b]	MJ/ton/km	Eom et al. (2012), Fig. 12
Emission factor for road transport diesel consumption	79,3 [a]	g CO_2e/MJ	The Swedish Energy Agency (2018)

[a] For more information, see Appendix 2.
[b] The average energy use associated with heavy trucking in Sweden in 2007.

In order to calculate the greenhouse gas emissions associated with energy use, we first estimated how much electricity the DJ-booth, i.e., the equipment inside the DJ-booth, uses during the entire festival. The equipment inside the DJ-booth consumes an average of 3 kW when it is used, and we assumed that it is used for 12 hours per day, for three days. All electricity is generated in on-site diesel generators with a conversion efficiency of 20%, powered by EcoPar A, see Appendix 1. The greenhouse gas emissions associated with energy use were calculated as the total electricity consumption multiplied by the conversion efficiency of the diesel generators and the emission factor for EcoPar A, see Table 14.

The greenhouse gas emissions associated with transportation were calculated based on the weight, the transport distance, the energy consumption associated with heavy trucking in Sweden, and the emission intensity of diesel consumption for road transport, see Table 14. The container is transported to Göteborg from Landskrona. After Way Out West, the container is transported to another festival. Therefore, only the emissions from transportation between Landskrona and Göteborg were included in the assessment.

Results

The carbon footprint of Oatly's DJ-booth is estimated to 236 kg CO_2e, of which production, energy use and transport is responsible for 15%, 60% and 25%, respectively (Table 15). The carbon footprint represents the emissions of greenhouse gases in carbon dioxide equivalents associated with producing the container, using the DJ-equipment inside the container, and transporting the container to the festival. Note that only a small fraction of the production-related emissions was allocated to Way Out West 2019.

Table 15 The carbon footprint of Oatly's DJ-booth, and for separate parts.

	Carbon footprint (kg CO2e)
Production-related emissions allocated to Way Out West 2019	37
Energy use (of the DJ-equipment)	141
Transport (one way, by truck)	59
Total	**236**

Café container

Method and data

Svalna calculated the carbon footprint of Oatly's café container using the data and information in Table 16. The assessment includes the emissions of greenhouse gases associated with production, energy use and transport. The emissions associated with producing and transporting the materials and machines contained inside the café container, e.g., fridges and blenders, were not included (the carbon footprint of the coffee machine is however calculated and reported separately).

The greenhouse gas emissions associated with production were estimated to 16,4 ton CO_2e, based on the weight of the container, and the emission factor for carbon steel in Table 16. The emission factor for carbon steel captures the emissions associated with production and refinement; emissions associated with raw material mining and assembly are not included, but can be considered negligible in comparison.

Oatly bought the container new in 2014, and uses it approximately 12 times per year. Svalna estimated its lifetime to 15 years, i.e., we assumed that it is going to be used 180 times in total (counting Way Out West 2019 as "one time"). An equally large share of the production-related emissions (1/180) were allocated to Way Out West 2019.

Table 16 Information and data about Oatly's café container used for calculating its carbon footprint.

	Value/information	Unit	Source
Production			
Material	Carbon steel		Oatly
Weight	5,12	ton	Oatly
Emissions factor for carbon steel production (ore-based, blast furnace)	3,2	kg CO_2e/kg	Svalna
Times used per year	12	times	Oatly
Estimated years in service	15	years	Oatly
Fraction of production related emissions allocated to Way Out West 2019	0,6%		Calculated by Svalna
Total carbon footprint associated with production	16,4	ton CO_2e	Calculated by Svalna
Energy use			
Estimated energy consumption of two blenders	50 [a]	kWh	Calculated based on data from Oatly
Estimated energy consumption of the fridges in the container	108 [b]	kWh	Calculated based on data from Oatly
Estimated energy consumption associating with lighting	18 [c]	kWh	Calculated based on data from Oatly
Energy consumption of the coffee machine	65	kWh	Calculated by Svalna
Estimated energy consumption of a coffee grinder	13	kWh	Estimated by Oatly
Source of electricity	100% from diesel		Oatly
Conversion efficiency of diesel generators	28% [d]		Luger & EcoPar A
Emission factor for diesel (EcoPar A) used in on-site diesel generators	72,4 [e]	g CO_2e/MJ	Calculated based on info in ICF (2012)
Transport			
Base station	Landskrona		Oatly
Transport distance (Landskrona to Göteborg)	240	km	
Transport method	Truck		Oatly
Energy consumption associated with road transport	1,5 [f]	MJ/ton/km	Eom et al (2012), Fig. 12
Emission factor for road transport diesel consumption	79,3 [e]	g CO_2e/MJ	The Swedish Energy Agency (2018)

[a] Calculated based on a power consumption of 1,4 kW, assuming the two blenders are used (at full power) 50% of the time (72 hours in total).
[b] Calculated based on a power consumption of 1,5 kW, and 72 hours of use.
[c] Calculated based on a power consumption of 0,5 kW, and 36 hours of use.
[d] For more information, see Appendix 1.
[e] For more information, see Appendix 2.
[f] The average energy use associated with heavy trucking in Sweden in 2007.

In order to calculate the greenhouse gas emissions associated with energy use, we first estimated how much electricity Oatly's café container, i.e., the machines inside the container, consume during the festival. This includes the electricity used by all machines and electricity-consuming objects in the café container, namely fridges, lamps, a coffee machine, a coffee grinder and two blenders. The container including lamps and fridges consume an average of 2 kW during the day (12 hours per day), and 1,5 kW during the night (the fridges always consume energy). All electricity is generated in on-site diesel generators with a conversion efficiency of 20%, powered by EcoPar A, see Appendix 1. The greenhouse gas emissions associated with energy use were calculated as the total electricity consumption multiplied by the conversion efficiency of the diesel generators and the emission factor for EcoPar A, see Appendix 2.

The greenhouse gas emissions associated with transportation were calculated based on the weight, the transport distance, the energy consumption associated with heavy trucking in Sweden, and the emission intensity of diesel consumption for road transport, see Table 16. The container is transported to Göteborg from Landskrona. After Way Out West, the container is transported to another festival. Therefore, only the emissions from transportation between Landskrona and Göteborg were included in the assessment.

Results

The carbon footprint of the café container is estimated to 474 kg CO_2e, of which production, energy use and transportation is responsible for 19%, 50% and 31%, respectively (Table 17). The carbon footprint represents the emissions of greenhouse gases in carbon dioxide equivalents associated with producing the container, using the machines inside the café container during the festival (fridges, lamps, a coffee machine, a coffee grinder and two blenders), and transporting the container to the festival. Note that only a small fraction of the production-related emissions was allocated to Way Out West 2019.

Table 17 The total carbon footprint of Oatly's café container, and for separate parts.

	Carbon footprint (kg CO_2e)
Production-related emissions allocated to Way Out West 2019	91
Energy use (of fridges, lamps, a coffee machine, a coffee grinder and two blenders)	237
Transportation (one-way, by truck)	146
Total	**474**

Coffee machine

Method and data

Svalna calculated the carbon footprint of the coffee machine using the information in Table 18. The assessment includes the emissions of greenhouse gases associated with production and energy use during Way Out West 2019. Emissions associated with transportation were considered negligible due to the low weight of the machine, hence excluded.

Table 18 Information and data about the coffee machine used for calculating its carbon footprints.

	Value/information	Unit	Source
Production			
Brand and model	La Marzocco Linea Classic 2 Groups		Oatly
Machine weight	51	kg	La Marzocco
Estimated total lifetime service hours	10 800 [a]	hours	La Marzocco/Svalna /Oatly
Material share stainless steel	95%		Own estimate based on info from La Marzocco
Material share brass	3%		Own estimate based on info from La Marzocco
Material share plastic	1,5%		Own estimate based on info from La Marzocco
Material share electronics	0,5%		Own estimate based on info from La Marzocco
Emission factor for stainless steel production	5,3 [b]	kg CO_2e/kg	Svalna
Emission factor for brass (60% Cu, 40% Zn) production	4,7 [b]	kg CO_2e/kg	Svalna
Emission factor for plastic (PVC) production	2,5 [b]	kg CO_2e/kg	Svalna
Emission factor for electronics production	208 [c]	kg CO_2e/kg	Svalna
Total carbon footprint associated with production, incl. assembly	498	kg CO_2e/ machine	Calculated by Svalna
Fraction of production related emissions allocated to Way Out West 2019	0,3%		Calculated by Svalna
Energy			
Power consumption	3,6	kW	La Marzocco
Estimated use rate during Way Out West	50%		Oatly
Hours of use during Way Out West	36		Oatly
Source of electricity	100% from diesel		Oatly
Conversion efficiency of diesel generators	28% [d]		Luger & EcoPar A
Emission factor for diesel (EcoPar A) used in on-site diesel generators	72,4 [e]	g CO_2e/MJ	Calculated based on info in ICF (2012)

[a] Assuming the coffee machine is used approximately three times as much as the food container, i.e., at 36 events per year (Oatly's estimate), and that each event lasts for 10 hours per day, for three days, and that the coffee machine is used for 10 years in total.
[b] Global average of production from recycled and virgin material.
[c] As an approximate value for electronics, we used the average value for four different laptops (since laptops are almost completely made of electronics).
[d] For more information, see Appendix 1.
[e] For more information, see Appendix 2.

The greenhouse gas emissions associated with production and assembly were estimated to 498 kg CO_2e. First, we calculated the greenhouse gas emissions associated with production and refinement of the constituent materials based on the weight of the materials, and the emission factors in Table 18. These emission factors capture the emissions associated with production and refinement, but not of raw material mining (which can however be considered negligible in comparison). Information about constituent materials was obtained from the manufacturer, while the mass share of each material are our own estimates.

Then, we estimated the greenhouse gas emissions associated with assembly of the machine by assuming that raw material extraction and refinement contribute 64% of the total carbon footprint associated with production, and that production and transportation of components, and assembly and packaging of the machine, make up the remaining part. The factor 64% is based on Babarenda Gamage et al. (2008) who calculated the carbon footprint for an office chair using life cycle assessment. While there is obviously a large difference between an office chair and a coffee machine, they were considered comparable in this respect, since they both consist mostly of metal, and of many smaller components which are assembled in a factory into a functional whole. While this is a rough assumption, it is considered acceptable in this case, since the greenhouse gas emissions associated with production are very low in comparison to the greenhouse gas emissions associated with energy use.

Oatly, who owns the coffee machine, estimates that it is used approximately three times as much as the food container, i.e., at 36 events per year. Assuming that each event lasts for three days, and that the coffee machine is used for 10 hours per day, and for 10 years in total, we estimated the total lifetime service hours of the coffee machine to 10 800 hours. Thirty six hours of use during Way Out West 2019 thus represent 0,3% of the total lifetime service hours, and an equally large share of the production-related emissions were allocated to Way Out West 2019.

The greenhouse gas emissions associated with energy use were calculated based on the power consumption of the coffee machine, and the assumption that the machine uses 50% of its power during the hours it is used. All electricity is generated in on-site diesel generators with a conversion efficiency of 28%, powered by EcoPar A, see Appendix 1. The greenhouse gas emissions associated with energy use were calculated as the total electricity consumption multiplied by the conversion efficiency of the diesel generators and the emission factor for EcoPar A, see Appendix 2.

Results

The carbon footprint of the coffee machine is estimated to 62,0 kg CO_2e, of which production and energy consumption is responsible for 3% and 97%, respectively (Table 19). The carbon footprint represents the emissions of greenhouse gases in carbon dioxide equivalents associated with producing the coffee machine and using it during Way Out West 2019. Note that only a small fraction of the production-related emissions was allocated to Way Out West 2019.

Table 19 The carbon footprint of Oatly's coffee machine used at Way Out West.

	Carbon footprint (kg CO_2e)
Production-related emissions allocated to Way Out West 2019	1,7
Energy use (electricity generated by on-site diesel generators)	60,3
Total carbon footprint	**62,0**

Monitor and PC

Method and data

Svalna calculated the carbon footprint of Oatly's PC and monitor, using the information in Table 20. The assessment includes the emissions of greenhouse gases associated with production and energy use during Way Out West 2019. Emissions associated with transportation were considered negligible due to the low weight of the machines, hence excluded.

Table 20 Information and data about the PC and monitor used for calculating their carbon footprints.

	Data value/ information	Unit	Source
PC			
Brand and model	Intel NUC6I7KYK		Oatly
Weight incl. power adapter	1	kg	Oatly
Power consumption incl. power adapter	60	W	Oatly
Monitor			
Brand and model	Samsung ME46B		Oatly
Weight excl. wall holder	12,5	kg	Samsung
Operational power consumption	110	W	Samsung
Other data (used for both the PC and monitor)			
Source of electricity	100% from diesel		Oatly
Hours of use during Way Out West 2019 (with average power consumption)	36	hours	Oatly
Estimated total lifetime service hours	810 [a]	hours	Estimated based on info from KSE & Oatly
Fraction of production-related emissions allocated to Way Out West 2019	4,4%		Calculated by Svalna
Conversion efficiency of diesel generators	28% [b]		Luger & EcoPar A
Emission factor for diesel (EcoPar A) used in on-site diesel generators	72,4 [c]	g CO_2e/MJ	Calculated based on info in ICF (2012)

[a] Assuming the PC and monitor are used on average 12 hours per day, 15 days per year, for 4,5 years.
[b] For more information, see Appendix 1.
[c] For more information, see Appendix 2.

The PC is an Intel NUC6I7KYK, and the monitor is a Samsung ME46B. No life cycle assessments are available from the manufacturers. Instead, we used data from life cycle assessments made by Apple, of similar products, only correcting for the differences in weight between products. The carbon footprint of the Intel PC was estimated using the carbon footprint of a 15-inch MacBook Pro (only considering the greenhouse gas emissions associated with production), and the carbon footprint of the Samsung monitor was estimated using the carbon footprint of a 21,5-inch iMac with Retina 4K display (only considering the greenhouse gas emissions associated with production).

The PC and monitor were assumed to be used on average 15 days per year, for 12 hours per day, and for 4,5 years, based on information from Oatly and KSE; the company that Oatly rents the PC and monitor from. Thirty six hours of use during Way Out West 2019 thus represent 4,4% of the total lifetime service hours, and an equally large share of the production-related emissions were allocated to Way Out West 2019.

In order to calculate the greenhouse gas emissions associated with energy use, we first estimated how much electricity the monitor and PC (incl. the power adapter) consume throughout the festival, based on their power consumption, assuming they are used on average 12 hours per day, for three days. All electricity used by the monitor and PC is generated by on-site diesel generators with a conversion efficiency of 28%, powered by EcoPar A, see Appendix 1. The greenhouse gas emissions associated with energy use were calculated as the total electricity consumption multiplied by the conversion efficiency of the diesel generators and the emission factor for EcoPar A, see Appendix 2.

Results

The carbon footprints of the PC and monitor are estimated to 7,9 and 28,5 kg CO_2e, respectively, see Table 21. These values represent the emissions of greenhouse gases in carbon dioxide equivalents associated with production and energy use during Way Out West 2019. Note that only a small fraction of the production-related emissions was allocated to Way Out West 2019.

Table 21 The carbon footprints of the monitor and PC, and for separate parts.

	Carbon footprint (kg CO_2e)	
	PC	**Monitor**
Production-related emissions allocated to Way Out West 2019	5,9	24,8
Energy use (electricity generated by on-site diesel generators)	2,0	3,7
Total carbon footprint	**7,9**	**28,5**

Lounge chairs

Method and data

Svalna calculated the carbon footprint of the lounge chairs using the information in Table 22. The carbon footprint represents the total greenhouse gas emission associated with material production; no allocation of production-related emissions based on the time of use at Way Out West 2019 was done. Due to the low weight of the chairs, and the limited number (20), the emissions associated with transportation were not included.

The chairs consist of a frame made of wood, and a fabric made of polyester. We assumed that the production of the wood frame did not generate any greenhouse gas emissions, since wood sequesters carbon (thereby preventing carbon dioxide from being released to the atmosphere), and since the frame can be considered a rather long-lived product (perhaps 10-20 years).

The carbon footprint of the lounge chair was estimated as the weight of the polyester fabric multiplied by the emission factor for polyester fiber. The emission factor for polyester fiber was obtained from Sandin et al., (2019); a thorough and recent review of the environmental impacts of different types of fiber, and includes the emissions associated with material production. According to Sandin et al. (2019), the emission factor for polyester fiber ranges between 1,7 and 4,5 kg CO_2e per kg of fiber. We used the highest value in this range (4,5 kg CO_2e per kg of fiber) to compensate for the fact that we did not consider any emissions associated with fabric production, cutting and sewing.

Emissions associated with assembly of the various parts into a functional chair were not included, but can be considered negligible in comparison with the energy associated with material production.

Table 22 Information and data about the lounge chairs used for calculating the carbon footprints.

	Value/information	**Unit**	**Source**
Material	Wooden framework and polyester fabric		Oatly
Weight wooden framework per chair	3200	g	Oatly
Weight polyester fabric per chair	300	g	Oatly
Emission factor for polyester fiber production	4,5	kg CO_2e/kg	Sandin et al (2019), p. 36
Emission factor for wood production	0	kg CO_2e/kg	Svalna
Number of lounge chairs that are used at Way Out West	20		Oatly

Results

The carbon footprint of one lounge chair is estimated to 1,4 kg CO_2e, and the carbon footprint of all 20 lounge chairs that are used at Way Out West 2019 is estimated to 27 kg CO_2e, see Table 23. The carbon footprints represent the emissions of greenhouse gases in carbon dioxide equivalents associated with production. All production-related emissions were allocated to Way Out West 2019.

Table 23 The carbon footprints of Oatly's lounge chairs that were used at Way Out West 2019.

	Carbon footprint (kg CO_2e)
One lounge chair	1,4
All 20 lounge chairs	27

Staff clothes: short- and long-sleeved t-shirts and sweatshirts

Method and data

Staff clothes for Oatly staff at Way Out West include a short- and long-sleeved t-shirt, and a sweatshirt. Svalna calculated the carbon footprint per garment, and the total carbon footprint for all garments, using the data in Table 24. The carbon footprints represent the total greenhouse gas emissions associated with material production (cotton cultivation, fabric production, sewing, etc.); no allocation of production-related emissions based on the time of use at Way Out West 2019 was done. Emissions from transportation and energy use associated with using the clothes (e.g. when washing) are not included.

Table 24 Information and data about the staff clothes used for calculating the carbon footprints.

	Value/information	**Source**
Manufacturer	Stanley & Stella	Oatly
Origin	Bangladesh	Stanley & Stella
Weight per garment, short-sleeved t-shirt	160 g	Oatly
Weight per garment, long-sleeved t-shirt	170 g	Oatly
Weight per garment, sweatshirt	700 g	Oatly
Material short- and long-sleeved t-shirts	100% organic cotton	Oatly
Material, sweatshirt	85% organic cotton and 15% recycled polyester	Oatly
Total number of short-sleeved t-shirts	60	Oatly
Total number of long-sleeved t-shirts	40	Oatly
Total number of sweatshirts	40	Oatly
Carbon footprint of a 153 g cotton t-shirt made in China	4,96 kg CO_2e	Zhang et al. (2015)

The manufacturer, Stanley & Stella, have not estimated the carbon footprints of their products (V. Szalai, pers. comm., 2019). The carbon footprints of the clothes were instead estimated based on data from Zhang et al. (2015), who used life cycle assessment to calculate the carbon footprint of cotton t-shirts produced in China (the clothes used at Way Out West were produced in Bangladesh, but the production systems in China and Bangladesh can be considered similar). We assumed that the work (hence the energy consumption) required to sew a long-sleeved t-shirt and a sweatshirt is about the same as for a short-sleeved t-shirt.

The sweatshirt consists of 15% recycled polyester. Sandin et al. (2019) recently made a large and thorough review of the environmental impacts of different types of fiber, concluding that the carbon footprint of polyester fiber ranges between 1,7 to 4,5 kg CO_2e per kg of fiber, and that the carbon footprint of cotton fiber ranges between 0,5 to 4,0 kg CO_2e per kg of fiber. This means that cotton fiber and polyester fiber can be considered to have about the same climate impact (since the figures are within roughly the same range). Therefore, we simply disregarded the 15% of recycled polyester, and used data from Zhang et al. (2015) to calculate the carbon footprint of the entire 700 g sweatshirt.

The carbon footprint of a 153 g cotton t-shirt is 4,96 kg CO_2e, according to Zhang et al. (2015). This value includes the emissions from cotton cultivation (and all emissions from the production of agricultural inputs such as pesticides and fertilizers); the emissions from energy use associated with cultivation, irrigation and harvesting of cotton, and the emissions from energy use associated with production of fabric from cotton, dyeing, sewing and packaging (the emissions from garment use and waste disposal were excluded). The carbon footprints were finally calculated by correcting for the differences in weight between the different garments, and the t-shirt in Zhang et al. (2015), see Table 24.

We used data from Zhang et al. (2015) even though they studied a t-shirt made of conventionally grown cotton, whereas the staff clothes are made of organic cotton, since it is not possible to differentiate between organic and conventionally grown cotton with regard to climate impacts, see Appendix 3.

The total carbon footprints associated with all staff clothes used by Oatly staff at Way Out West 2019 were calculated as the carbon footprint per garment multiplied by the total number of garments purchased.

Results

The carbon footprints of the short- and long sleeved t-shirts are estimated to 5,2 and 5,5 kg CO_2e, respectively, and the carbon footprint of the sweatshirt is estimated to 23 kg CO_2e, see Table 25. The carbon footprints represent the emissions of greenhouse gases in carbon dioxide equivalents associated with garment production (including cotton cultivation, fabric production, sewing, etc.). All production-related emissions were allocated to Way Out West 2019.

Table 25 The carbon footprints of the staff clothes used at Way Out West 2019.

	Carbon footprint (kg CO_2e)
One short-sleeved t-shirt	5,2
All short-sleeved t-shirts (60 pieces)	311
One long-sleeved t-shirt	5,5
All long-sleeved t-shirts (40 pieces)	220
One sweatshirt	23
All sweatshirts (40 pieces)	908

Gym bags

Method and data

Svalna calculated the carbon footprint per gym bag, and the total carbon footprint for all gym bags, using the data in Table 26. The carbon footprints represent the total greenhouse gas emission associated with material production (cotton cultivation, fabric production, sewing, etc.); no allocation of production-related emissions based on the time of use at Way Out West 2019 was done. Emissions from transportation and energy use associated with using the gym bag (e.g. from washing) are not included.

The manufacturer, Stanley & Stella, have not estimated the carbon footprints of their products (V. Szalai, pers. comm., 2019). The carbon footprint of the gym bags were instead estimated based on data from Zhang et al. (2015), who used life cycle assessment to calculate the carbon footprint of cotton t-shirts produced in China (the gym bags used at Way Out West were produced in Bangladesh, but the production systems in China and Bangladesh can be considered similar). We assumed that the materials are similar (both are made of 100% cotton) and that the work (hence, the energy consumption) required to sew a gym bag is about the same as for a short-sleeved t-shirt.

Table 26 Information and data about the gym bag used for calculating the carbon footprint.

	Value/information	**Source**
Manufacturer	Stanley & Stella	Oatly
Origin	Bangladesh	Stanley & Stella
Weight per gym bag (g)	200	Oatly
Total number of gym bags purchased to Way Out West 2019	2000	Oatly
Material	100% organic cotton	Oatly

The carbon footprint of a 153 g cotton t-shirt is 4,96 kg CO_2e, according to Zhang et al. (2015). This value includes the emissions from cotton cultivation (and all emissions from the production of agricultural inputs such as pesticides and fertilizers); the emissions from energy use associated with cultivation, irrigation and harvesting of cotton, and the emissions from energy use associated with production of fabric from cotton, dyeing, sewing and packaging (the emissions from garment use and waste disposal were excluded). By correcting for the differences in weight (the gym bag weighs 200 g, and the t-shirt in Zhang et al. (2015) weighs 153 g), the carbon footprint was estimated to 6,5 kg CO_2e per 200 g, which is the value we used for the gym bag.

We used data from Zhang et al. (2015) even though they studied a t-shirt made of conventionally grown cotton, whereas the gym bags used as give-aways at Way Out West are made of organic cotton, since it is not possible to differentiate between organic and conventionally grown cotton with regard to climate impacts, see Appendix 3.

The total carbon footprint of all gym bags purchased by Oatly and used as give-aways at Way Out West 2019 were calculated as the carbon footprint per gym bag multiplied by the total number of gym bags purchased.

Results

The carbon footprint of a gym bag is estimated to 6,5 kg CO_2e, and the carbon footprint of all gym bags is estimated to 13 ton CO_2e (Table 27). The carbon footprints represent the emissions of greenhouse gases in carbon dioxide equivalents associated with production (including cotton cultivation, fabric production, sewing, etc.). All production-related emissions were allocated to Way Out West 2019.

Table 27 The carbon footprints of the gym bags used as give-aways at Way Out West 2019.

	Carbon footprint
One gym bag	6,5 kg CO_2e
All gym bags (2000 gym bags)	13 ton CO_2e

Part 3: Outside the festival - Nöjesguiden

In part 3, Svalna calculated carbon footprints associated with Nöjesguiden.

Method and data

The printing house Stibo Graphic prints Nöjesguiden. Stibo Graphic has calculated the carbon footprint of issue #7 of Nöjesguiden to 4,3 ton CO_2e, using their own carbon footprint calculator "ClimateCalc". The result includes the emissions from paper production, printing and transport, but excludes the local distribution (P. Tamleht, pers. comm., 2019).

Svalna has verified that Stibo Graphic's estimate makes sense by estimating the carbon footprint of issue #7 of Nöjesguiden using Svalna's own data on the greenhouse gas emissions per kg of newsprint, the weight of one magazine, and the number of magazines in issue #7, see Table 28. Svalna's emission factor for newsprint, however, only includes the primary production of wood and paper, and does not include the emissions associated with printing and transport.

Table 28 Information and data used for calculating the carbon footprint of the magazine Nöjesguiden.

	Information/data value	Unit	Source
Carbon footprint of issue #7	4,3	ton CO_2e	Stibo Graphic
Carbon footprint of issue #7	5,1	ton CO_2e	Svalna's estimate
Paper type	Not recycled		Nöjesguiden
Number of magazines in issue #7	100 000		Nöjesguiden
Emission factor for newsprint production	0,19 [a]	kg CO_2e/kg	Svalna
Weight per magazine in issue #7	0,27	kg	Nöjesguiden/Stibo Graphic
Number of pages in issue #7	80		Nöjesguiden

[a] This value refers to paper made to 100% from thermo-mechanical pulp made from Swedish wood (i.e.; not recycled paper), and is based on the assumption that 91% of the paper is recycled and that 9% is incinerated, at the end of life, based on data from FTI (Förpacknings- och tidningsinsamlingen, www.ftiab.se), referring to the year 2018. Only emissions associated with forestry, pulp production and paper production are included; emissions associated with printing and distribution are not included, and neither are the long-term effects on the forest carbon stock associated with forestry.

Svalna estimates the carbon footprint of issue #7 of Nöjesguiden to 5,1 ton CO_2e, which is fairly close to the value calculated by Stibo Graphic. Based on this, we concluded that the value 4,3 ton CO_2e is reasonable, and we used it to calculate the carbon footprint of one magazine in issue #7, and of one page in issue #7, by dividing the carbon footprint of the whole issue #7 by the number of magazines in issue #7, and the number of pages in issue #7, see Table 28.

Results

The carbon footprint of issue #7 of Nöjesguiden (all 100 000 magazines) is estimated to 4,3 ton CO_2e; the carbon footprint of one magazine in issue #7 of Nöjesguiden is estimated to 43 g CO_2e, and the carbon footprint of one page in issue #7 of Nöjesguiden is estimated to 0,54 g CO_2e (Table 29). The carbon footprints include the emissions of greenhouse gases in carbon dioxide equivalents associated with paper production, printing and transportation (excluding local distribution).

Table 29 The carbon footprints of Nöjesguiden issue #7, for one magazine in issue #7, and for one page in issue #7.

	Carbon footprints
Issue #7 of Nöjesguiden (all 100 000 magazines)	4,3 ton CO_2e
One magazine in issue #7 of Nöjesguiden	43 g CO_2e
One page in issue #7 of Nöjesguiden	0,54 g CO_2e

References

Babarenda Gamage, G., Boyle, C., McLaren, S. J., & McLaren, J. (2008) *Life cycle assessment of commercial furniture: a case study of Formway LIFE chair*. The International Journal of Life Cycle Assessment, 13(5), 401–411.

Dahlgren, K., Emilsson, H., Månsson, A. (2019) *Klimatanalys av el från GodEl*. U&We, 32 pp. [online] Accessed 1st of August, 2019.

EEPN (2013) *A discussion paper commissioned by the European Environmental Paper Network's Paper Efficiency Project 'Paper Vapour' – the climate impact of paper consumption*. European Environmental Paper Network, 15 pp [online]. Accessed 1st of August, 2019.

Eklund, A. (2019) R&D Manager, EcoPar AB, personal communication.

Eom, J., Schipper, L. & Thompson, L. (2012) *We keep on truckin': Trends in freight energy use and carbon emissions in 11 IEA countries*. Energy Policy, 45, 327-341.

Gode, J., Byman, K., Persson, A., & Trygg, L. (2009). *Miljövärdering av el ur systemperspektiv. En vägledning för hållbar utveckling.* Stockholm: IVL Svenska Miljöinstitutet.

HaV (2014) *Att installera vakuumtoalett i befintliga hus eller vid nybyggnation.* Havs- och Vattenmyndigheten [online]. Accessed 1st of August, 2019.

Hedin, L. (2013) *Toapapper – test*. Göteborgs-Posten, June 21, 2013 [online]. Accessed 1st of August, 2019.

ICF (2012) *Life Cycle Greenhouse Gas Emissions of Natural Gas. A LITERATURE REVIEW OF KEY STUDIES COMPARING EMISSIONS FROM NATURAL GAS AND COAL*. ICF CONSULTING CANADA, 8 pp.

Kamb, A. and Larsson, J. (2019) *Climate footprint from Swedish residents' air travel*. Chalmers University of Technology.

Koehler, A., & Wildbolz, C. (2009) *Comparing the environmental footprints of home-care and personal-hygiene products: the relevance of different life-cycle phases, Supporting Information.* Environmental science & technology, 43(22), 8643-8651

Martinsson, F., Gode, J. Arnell, J., Höglund, J. (2012) *Emissionsfaktor för nordisk elproduktionsmix. PM för Energimyndigheten*. Stockholm: IVL Svenska Miljöinstitutet.

Moberg, Å., Wranne, J., Martinsson, F., & Thornéus, J. (2016) *Miljökartläggning av hotellverksamhet* (Nr U 5672). Stockholm: IVL Svenska Miljöinstitutet.

Nilsson, J. (2019) EcoPar AB, personal communication.

Roos, S. (2019) RISE Research Institutes of Sweden, personal communication.

Sandin, G., Roos, S., Johansson, M. (2019) *Environmental impact of textile fibers – what we know and what we don't know*. The fiber bible part 2. Mistra Future Fashion report number: 2019:03, part 2.

Statistics Sweden (2019) Miljöräkenskaper. [online] Accessed 1st of August, 2019.

Swedish Energy Agency (2018) *Drivmedel 2017 redovisning av uppgifter enligt drivmedelslagen och hållbarhetslagen*. ER 2018:17. The Swedish Energy Agency: Eskilstuna.

Swedish Energy Agency (2011) *Energianvändning i hotell, restauranger och samlingslokaler. Förbättrad statistik för lokaler, STIL2*. ER2011:11. The Swedish Energy Agency: Eskilstuna. [online] Accessed 1st of August, 2019.

Szalai, V. (2019) Sustainability Officer, Stanley and Stella S.A, personal communication.

Tamleht, P. (2019) Nöjesguiden, personal communication.

Thomas, G. (2000) *Overview of Storage Development DOE Hydrogen Program*. Livermore, CA. Sandia National Laboratories. [online] Accessed 1st of August, 2019.

Zhang, Y., Liu, X., Xiao, R., & Yuan, Z. (2015) *Life cycle assessment of cotton T-shirts in Chin*a. The International Journal of Life Cycle Assessment, 20(7), 994–1004.

Appendix 1: Conversion efficiencies of diesel generators

Of the electricity used on site, approximately three quarters is generated in on-site diesel generators of the type “KåBe Power - Iveco steg 3A”, powered by EcoPar A, see Appendix 2. Considerable amounts of energy is lost as heat in the conversion process. The conversion efficiency is defined as the ratio between the useful output and the input, in energy terms.

We differentiated between diesel generators used to supply power to the stages and to Oatly’s DJ-booth, and diesel generators used to supply power to all other electricity-consuming appliances and machines, see Table 30.

The conversion efficiency of the generators used to supply power to the main stage and to Oatly’s DJ-booth was estimated to 20%, based on data from Luger. This rather low conversion efficiency is explained by the fact that many generators run idle much of the time, in order to maintain a high capacity and be able to handle sudden and large increases in power consumption during concerts.

The conversion efficiency of all other diesel generators was estimated to 28%, based on information from Luger that 1 liter of EcoPar A generates 3 kWh of electricity, and information from J. Nilsson (pers. comm., 2019) that 1 liter of EcoPar A contains 38,0 MJ (which corresponds to 10,6 kWh/liter).

Table 30 Conversion efficiencies of on-site diesel generators.

	Conversion efficiency
Diesel generators used to supply power to all stages and Oatly’s DJ-booth	20%
All other diesel generators	28%

Appendix 2: Emission factors for electricity and diesel

Diesel for road transport and for electricity generated on the site

Carbon dioxide is produced and emitted when diesel fuel (made up of hydrocarbons) is combusted. The amount depends on the efficiency of the combustion engine and on the type of diesel, e.g., what the diesel is made of. In this assessment, we differentiated between diesel used for road transport and diesel used in on-site diesel generators, see Table 31.

Diesel generators of the type "KåBe Power - Iveco steg 3A" are used on the festival grounds to generate electricity (the same generators were used in 2018, as in 2019). The generators are powered by EcoPar A, an extra clean type of diesel made from natural gas, that generates lower emissions of hazardous substances, such as nitrogen oxides, and lower emissions of carbon dioxide, than ordinary diesel (www.ecopar.se).

We estimated the life cycle greenhouse gas emission from EcoPar A to 72,4 g CO_2e/MJ. EcoPar A is made from natural gas (i.e., methane, CH_4), with an energy density of 50 MJ/kg (Thomas, 2000). One kg of natural gas contains 75% carbon, which generates 2,75 kg CO_2 when combusted (A. Eklund, pers. comm., 2019). Combustion of EcoPar A thus generates 55 g CO_2/MJ. Emissions associated with extraction and production of the fuel add another 17,4 g CO_2e/MJ, based on information in ICF (2012), and the latest Global Warming Potential value for methane (34, instead of 25 as used in ICF, 2012).

For road transport of goods and material, we used the yearly average emission factor for diesel MK1 in Sweden in 2017, from the Swedish Energy Agency (2018). The emission factor, 79,3 g CO_2e/MJ, represents the life cycle greenhouse gas emissions associated with diesel MK1, including the emissions from combustion, extraction and production of the fuel (Swedish Energy Agency, 2018).

Table 31 Life cycle greenhouse gas emission factors for grid electricity and diesel.

	Value	Unit	Source
Diesel (MK1) used for road transport	79,3 [a]	g CO_2e/MJ	Table 5 in the Swedish Energy Agency (2018)
Diesel (EcoPar A) used in on-site diesel generators	72,4	g CO_2e/MJ	Calculated based on info in ICF (2012) and the latest GWP-value for methane
Grid electricity (average electricity mix in the Nordic countries)	125,5 [b]	g CO_2e/kWh	Table 2 in Martinsson et al. (2012)

[a] The yearly average in Sweden in 2017 for diesel of the type MK1, including emissions from extraction and production.
[b] The average emission factor between 2005 and 2009 in the Nordic countries, calculated based on net export and import.

The emission factor for EcoPar A is 9% lower than the emission factor for road transport (Table 31). The reason is that EcoPar A is made from natural gas, while conventional diesel (which is what is typically used for road transport) is made from crude petroleum oil, and with 50 MJ/kg, the energy density of natural gas is higher than for crude petroleum oil (37,8 MJ/kg). One kg of natural gas (i.e., methane) contains 75% carbon, which generates 2,75 kg CO_2 when combusted, while petroleum crude oil typically contains 88% carbon, which generates 4,26 kg CO_2 when combusted (A. Eklund, pers. comm., 2019).

Electricity from the grid

Of the electricity used on site, approximately one quarter comes from the grid. The electricity provider God El supplies the electricity in 2019. Their electricity is based on 26% electricity from wind power and 74% from hydro power; it is labelled with the Swedish Nature Conservation Association's label "Bra Miljöval", and has an emission intensity of 11,26 g CO_2e/kWh in 2019, according to God El's own assessment (Dahlgren et al., 2019). However, instead of using the emission intensity calculated by God El, we used the emissions intensity of the average electricity mix in the Nordic countries, see Table 31.

The main reason behind this decision is that the choice of buying green electricity currently cannot be considered to have any system-driving effect, in the sense that it does not create any incentive for power suppliers to increase the production of renewable energy (Gode et al. 2011), since there is an overproduction of renewable electricity in the Nordic countries due to the large capacity of hydroelectric power generation.

The label "Bra Miljöval" used by God El does require that a small amount of money (500 SEK/GWh) is set aside to fund future internal or external energy efficiency improvements. This corresponds to ca. 3 SEK for Way Out West 2019 (6,1 MWh purchased off the grid, see Table 4), which can hardly be considered to have any system-driving effect, or create any "additionality", i.e., a potential for emission reductions[3].

One could of course argue that choosing to buy green electricity takes us one step closer towards a tipping point where the demand exceeds the supply, thereby forcing power suppliers to make the necessary investments in order to increase the production of renewable electricity, and that taking making this choice should merit some "credit". This reasoning has some merit; however, we are not there yet, and therefore, Svalna finds it most appropriate to use the emission intensity of the average Nordic electricity mix for the time being.

Event organizers or companies who wish to reduce the carbon footprint associated with the use of electricity should primarily focus on *minimizing the use* of electricity, rather than buying electricity from any particular provider, or with any particular label. Energy efficiency improvements or saved electricity in Sweden mean increased export of rather green electricity to other countries in Europe where it displaces electricity made to a larger extent from fossil sources.

[3] Although Svalna does not consider the label "Bra Miljöval" capable of creating additionality in terms of CO_2e-emission reductions, the technology-specific requirements aimed at safeguarding other environmental values that power suppliers who wish to use the label need to fulfil, surely creates other environmental benefits, but they are not included in the scope of this report.

Appendix 3: Organic cotton

Zhang et al. (2015) studied t-shirts made of conventionally grown cotton, but the clothes and gym bags used at Way Out West 2019 are made of organic cotton. Organic cotton have many advantages (for example, lower use of so-called blue water, and lower ecotoxic impacts since chemical pesticides are not used), but when it comes to climate impacts, there are too few studies to be able to say with certainty whether there is any significant difference between organic and conventionally grown cotton; see Sandin et al. (2019).

In general, climate impacts vary considerably between different kinds of cotton produced in different countries and with different methods, and the difference are often greater between studies and between farms, than between organic and conventionally grown cotton (S. Roos, pers. comm., 2019). Therefore, Svalna considered data from Zhang et al. (2015) appropriate for estimating the carbon footprints of the staff clothes and gym bags purchased by Oatly and used at Way Out West 2019.