Energy and Carbon Footprint of the Organic World Congress New Delhi

November 2017

International Federation of Organic Agriculture Movements

Cerana Foundation, Hyderabad

December 2017

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1. Introduction

1.1 The 19th Organic World Congress

The International Federation of Organic Agriculture Movements or IFOAM - Organics International has been a pioneer since the 1970s, as an international umbrella organization uniting an enormous diversity of stakeholders to contribute to an organic vision of world agriculture. Every 3 years, the organic agriculture sector comes together at the Organic World Congress (OWC), the world's largest and most significant gathering on the subject.

The 19th OWC was hosted in New Delhi, India at the India Exposition Mart Limited, Greater Noida, from November 9-11, 2017. The last OWC was hosted by Turkey in 2014 and the next will be held in France in 2020.

The theme of the 19th OWC was – 'An Organic World through an Organic India'. The conference was attended by over 2000 delegates from 90 countries and was visited by over 7000 day visitors. The congress was elaborately designed into 9 parallel congress tracks with 34 sessions in total spread over 3 days.

The OWC event was held concurrent to the 9th edition of BIOFACH India trade fair, a leading platform for the organic manufacturers and their target clients to network. The trade fair is believed to have been witnessed by about 10,000 visitors that include at least 50 international buyers from countries like Germany, Italy, USA, Indonesia, Turkey, Middle-East, China and South Korea, who visited the event so as to specifically extend their network and develop new procurement sources. It saw participation from a total of 184 exhibitors from India and the other countries, which includes organic trade missions from 40 countries. The exhibitors were leading organic food/non-food companies, certification bodies, government boards, to name a few. The OWC event turned out to be a congregation of organic farmers from around the world, engaging in knowledge exchange around innovations in organic farming practices.

The seed exhibition, another parallel event to the main congress, gave an opportunity to around 60 seed saver groups from 15 states of India to showcase over 4,000 varieties of seeds. This exhibition offered great networking opportunity for the farmers while it also encouraged on-farm conservation of seeds to emphasise the need for seed diversity.

The Indian hosts for this event were Organic Farming Association of India (OFAI) and PDA (Pradeep Deviah & Associates Pvt. Ltd.) Trade Fairs. OFAI, set up in 2002, promotes organic farming, lobbies with government agencies and departments to direct more attention to sustainable agriculture, and assists farmers doing chemical- or pesticide-based farming to successfully shift to organic farming methods. PDA Trade Fairs, a division of PDA, has been organising niche & industry-specific B2B international trade exhibitions, conferences and seminars in India and abroad for over a decade.

1.2 The need to reduce fossil fuel energy consumption and carbon emissions

Due to massive fossil fuel use and consequent excessive carbon dioxide (CO_2) emissions, global warming has already caused a temperature rise of 1°C over pre-industrial times. Despite efforts that countries are making to reduce their emissions, the earth is likely to heat up by 3-4°C by the end of this century.

The impact of such a temperature rise on the environment and human society will be disastrous. For example, Arctic ice could well disappear completely by the middle of this century, the Maldivian archipelago of 1,192 coral islands, some of the most beautiful islands in the world, would be completely drowned by the sea, and over 60 million Indians and Bangladeshis are estimated to become climate refugees, i.e., with no homes or land after their villages are drowned by the sea.

We are in an undeclared global crisis. To survive, human society will have to reduce greenhouse gas emissions drastically. The alternative is to perish.

1.3 Measuring and reducing the 19th OWC's energy and carbon footprint

Organic farmers are already doing their bit to reduce the greenhouse gas emissions by not using chemical fertilizers and pesticides, and by reducing water consumption and farm machinery. However, much more needs to be done. A beginning was made in the 18th OWC held in Istanbul by recognizing the need to reduce the carbon footprint of the OWC.

Progress has been made in the 19th OWC which took the following steps to measure and reduce the energy and carbon footprint of this conference.

- The use of plastic was drastically reduced by replacing it with organic materials in cutlery, cups, pens, delegate bags, information banners, and doing away with plastic altogether in some items such as delegate passes.

- The food provided at the conference venue was vegetarian, cooked locally with most ingredients sourced from nearby farms in Noida. The menu was kept limited to check food waste.

- To reduce local travel, about 300 conference delegates were accommodated in hotels within a 3 km radius from the conference venue, and a shuttle bus service was arranged.

- Paper consumption was reduced by limiting the number of flyers and other communication material.

- The 19th OWC commissioned Cerana Foundation[1] to study the energy and carbon footprint of this conference and suggest ways to reduce it in the next one.

[1] Cerana Foundation, a public interest group, consists of scientists and engineers specialized in risk mitigation. Sagar Dhara and Karnika Palwa did this study on behalf of Cerana Foundation.

2. Scope of work

The objective of the carbon and energy footprint study was to measure the energy consumption and carbon emissions of the OWC 2017, and make suggestions for reducing it in future congresses. The scope of the study was:

- To understand the processes and materials being used in the conference.
- To compute the energy consumption and carbon emission of the conference, and compute their savings due to measures taken by the organizers.
- To recommend practical alternative processes that can reduce the carbon footprint of the future conferences.

3. Methodology

3.1 Computation components

The total energy consumption and carbon emissions for OWC 2017 were treated as the sum of energy consumption and carbon emissions of the various major activities of the conference listed below.

- Electricity consumption during the conference period at the conference venue and at the accommodation provided to conference delegates.
- Fraction of embodied energy of the space used at the conference venue and at the accommodation provided to the delegates, for the period of the conference.
- Participants' travel to attend the conference, and for excursions organized by the conference.
- Organizational work that happened for two years prior to the OWC 2017 event in November 2017 that went into planning and organizing the conference, space hire, equipment use, travel, and organizers' support.
- Meals provided during the conference.
- Use of consumables and consumer durables in the conference.
- Undertaking the OWC energy and carbon footprint study.
- Waste generated by the conference.
- Energy consumption and carbon emissions due to conference's use of a fraction of Delhi's infrastructure during the conference period.

- Energy consumption and carbon emissions due to activities done as a consequence of the OWC, e.g. excursion trips to Agra by some delegates, eating out by delegates, and other similar activities.

3.2 Energy and carbon footprint computation method

Energy consumption and carbon emission were computed by multiplying the quantum of each activity by its energy consumption and carbon emission factors.

Using travel as an activity to explain the methodology, energy consumption and carbon emissions of travel done by each participant is broken into travel components or trips. Each trip has a specific distance and mode of transport, e.g., plane, bus, train, cab, and auto. The energy consumption and carbon emission of each trip is obtained by multiplying the trip distance with the energy consumption and carbon emission factors[2] for the mode of transport of that trip. Total energy consumption and carbon emissions for all travel of a participant is the summation of energy consumption and carbon emissions for all OWC-related trips (see Annexure IV). Similar exercises were done for each of the head categories listed above.

3.3 Carbon dioxide sequestration

Atmospheric CO_2 is sequestered back to earth by vegetation (forests and crops). The typical sequestration rates for both these types of vegetation are known for various parts of the world. A sequestration value of 20 kg per day per hectare, which is an average value for the Western Ghat forests of India, was used to compute the area of forest land required to sequester OWC's CO_2 emissions.

4. Data and computations

4.1 Data sources

Data used for this study came from two sources—OWC and the India Exposition Mart Limited (IEML**)** website. Data obtained from these sources two sources is provided in Annexure I. Where data essential for doing this study was unavailable, e.g., the ratio of male to female participants in the conference, suitable assumptions were made.

4.2 Data inadequacies

The work to organize the OWC 2017 started approximately 2 years before the congress was held in November 2017. As the decision to compute the conference's energy and carbon footprint was taken only a few months before the conference, data on activities and sub-activities that were undertaken prior to the conference were not recorded in the manner in which it is required for doing energy and carbon footprinting. For example, accurate data on the origin location and country of foreign and Indian delegates was never collected.

[2] Energy consumption and carbon emissions factors used in this study are from five energy and carbon footprint calculators developed by Cerana Foundation. The factors are based on Indian data.

Instead OWC had data on how many delegates paid delegate fees applicable for North American delegates, European, Australian and New Zealand delegates, Asian (other than Indian) delegates and Indian delegates. To compute travel footprints, this study made suitable assumptions regarding the average travel distance of each of these four categories of delegates.

The data that was important for this study, but was not available to the researchers who did this study included:

- Country-wise participants' details.

- An accurate head-count of the number of conference participants. The total number of delegates declared after the conference was about 500 persons more than the number of 2,000 considered for this study.

- The number of persons, other than delegates, who attended the conference. On the basis of information provided by OWC, this study factored 1,000 persons, other persons to have attended the conference daily. However, at the end of the conference the OWC organizers announced that the number of day visitors were 7,000.

- Data on delegate accommodation. There was no clear data for distance of accommodation from the venue, nature of accommodation and its amenities, possible mode of transport used to travel from the accommodation to the venue, exact number of people accommodated per venue.

- Many conference-related activities were not mentioned to the researchers doing this study, e.g., production of promotional films, organizing cultural programmes.

- A complete list of all equipment and materials used for the conference was not provided, e.g., audio-visual equipment (LCD screens, cameras, and computers), carpets, metal detectors, the huge terracotta display models and effigies on display in the registration hall, various banners and sign boards. Their energy and carbon footprints are therefore not factored into this study.

- Disposal method of plastic, paper and metal waste from the conference.

- The emissions resulting from the various security measures and privileges attached to the VIP presence at the conference.

- Information on 8 pre-conferences to the OWC, e.g., number participants in these pre-conferences, electricity consumption of the pre-conference venues, travel made by participants of these pre-conference events.

- No information was available to this study on the three day exhibition that was held at the same venue as OWC 2017. The OWC Post event report states that there were 253 exhibitors, including private stakeholders, over 15 state governments, government boards and certifying bodies. The exhibition attracted 10,000 visitors, including 50

international buyers. The number of business meetings held by those attending the exhibitions was 286.

- Details of the very large BIOFACH trade fair. The governing rules for BIOFACH were different from those of OWC, e.g., there was use of plastic cutlery and flex sheet banners at the exhibitor stalls in BIOFACH India exhibition. Though the BIOFACH trade fair was not officially part of the OWC, it was attended by OWC delegates, and therefore contributed as a consequential footprint to OWC.

4.3 Computations

Annexures II-XI present the detailed computations for the energy consumption and carbon emissions for each of the conference activities considered in this study.

Accuracy of computational results while dealing with large numbers such as those in this study tends to be on the lower side. Additionally, two other factors have contributed to a lower accuracy of the results obtained in this study—first, several conference activities were not considered in this study as they were not brought to the notice of researchers; and second, data inadequacies and inconsistencies, e.g., good travel data for each delegate, accurate conference participant numbers.

The missing data and data inadequacies listed in Sub-section 3.2 above would raise the energy consumption and carbon footprint by about 30-40%.

5. Results

5.1 Energy and carbon footprint of OWC 2017

The energy consumption and CO_2 emissions for each major activity head for OWC 2017 are summarized in Table 1 and Figure 1[3] (For detailed computations, see Annexures II-XI).

The percent contribution of each activity to the total energy consumption and total CO_2 emissions varies due to different fuel mixes used in these activities. Activities using more electricity will have higher CO_2 emissions as 1 kWh of delivered electricity emits 1 kg CO_2. Activities using liquid fuels or gas will have lower CO_2 emissions as 1 kWh of delivered energy from liquid fuels and gas will emit 0.29 and 0.22 kg CO_2, respectively. As electricity is generated largely by burning coal, its contribution to total energy consumed by OWC 2017 is lower than its contribution to total CO_2 emissions. The reverse holds true for travel.

The activities that were responsible for most of the energy and carbon footprint were:

- Travel (79.8% of energy consumption and 69% of CO_2 emissions)
- Activities associated with pre-conference organizing of the OWC (13.6% of energy consumption and 18% of CO_2 emissions)

[3] Pie charts for CO_2 emissions only have been provided as these charts capture the essence of the trends that data for energy consumption data provides

- Electricity consumption (2.3% of energy consumption and 7.7% of CO_2 emissions)

Table 1: Total energy consumption and carbon emissions of OWC 2017

Columns →	1	2	3	4	5
Rows[4] ↓					
1	Activity heads	Energy consumption (kWh)	Percentage of energy consumption	Carbon emissions (kg CO_2)	Percentage of carbon emissions
2	Electricity	1,72,955	2.25	1,72,955	7.69
3	Built-up space	15,117	0.20	7,256	0.32
4	Travel	61,39,448	79.81	15,50,339	68.95
5	Delhi infrastructure	90,411	1.18	20,548	0.91
6	Organizing the OWC	10,48,231	13.63	4,04,601	17.99
7	Food	45,546	0.59	14,404	0.64
8	Consequential events	1,51,653	1.96	50,968	2.27
9	Waste	1,412	0.02	1,412	0.06
10	Miscellaneous	25,094	0.33	25,094	1.12
11	Carbon footprint study	2,375	0.03	1,010	0.05
	TOTAL	**7,692,242**	**100**	**2,248,587**	100

Based on the reasons provided in sub-sections 4.2 and 4.3, the total energy consumption and CO_2 emissions obtained in Table 1 above may be increased by 35%. The results therefore are:

- **Estimated energy consumption by OWC 2017 = 10.36 million kWh = 888 toe**
- **Estimated CO2 emissions by OWC 2017 = 3,036 t CO_2**

The energy and carbon footprint for OWC 2017 indicates that:

- The energy consumed by OWC 2017 was roughly equal to 60% of the amount of energy in a Hiroshima-sized nuclear bomb.
- The CO_2 emission of OWC 2017 was roughly equal to one-third that of the annual emissions of the island nation Tuvalu[5].
- Assuming OWC 2017 had 3,000 participants; the energy consumption per OWC 2017 participant was 0.3 toe[6]; 50% higher than the annual per capita energy consumption of

[4] The row number in the table corresponds to the Annexure number that provides detailed energy consumption and carbon emission computations for the activity head in that row, e.g., Row 4 summarizes the energy consumption and carbon emission for the travel activity head, for which the detailed computations are provided in Annexure IV.

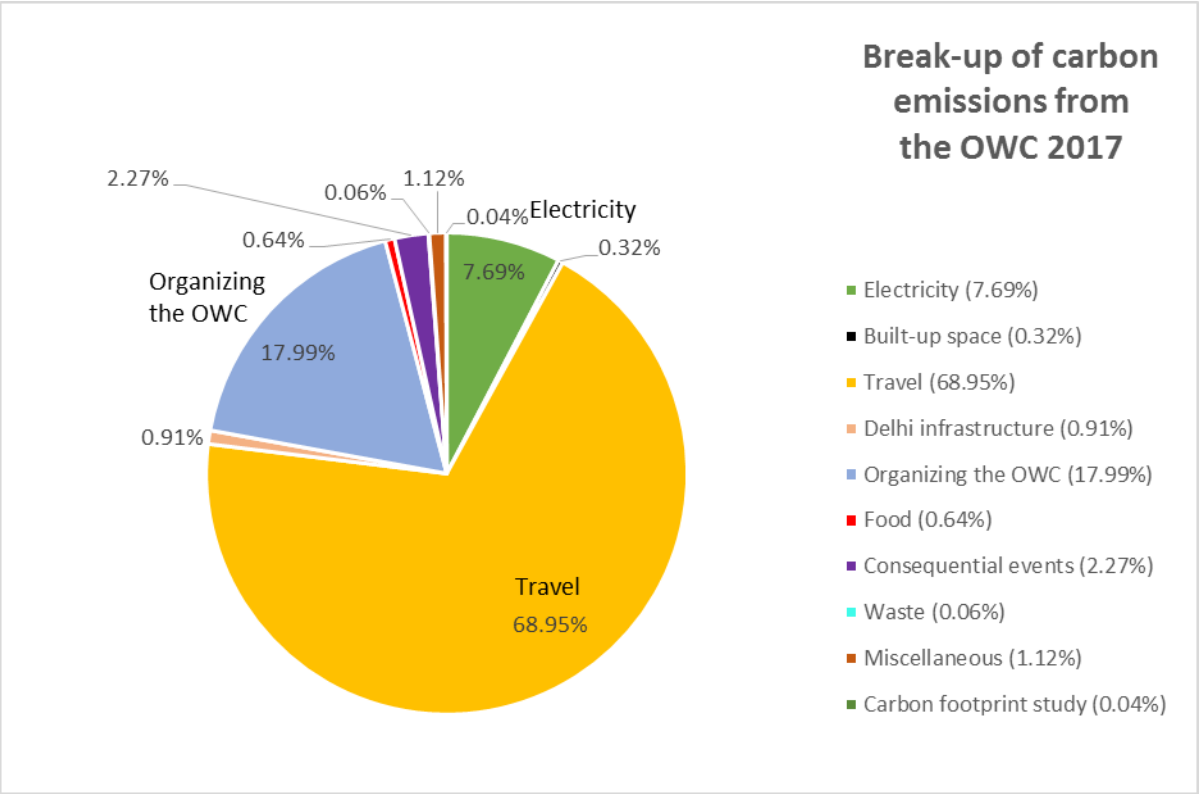
[5] Source: World Bank, https://data.worldbank.org/country/Tuvalu

an average Bangladeshi, and almost half the annual per capita energy consumption of an average Indian.

- The CO_2 emission per OWC 2017 participant for having participated in the conference was a little over 1 t CO_2; a value higher than the annual per capita CO_2 emissions in 58 countries[7] that have the lowest per capita CO_2 emissions; and a little over half the annual per capita CO_2 emissions of an average Indian (per capita of an average India is 1.9 t CO_2 per annum).

- The carbon emissions to do this study were 1 t CO_2, i.e., 0.05% of the carbon emissions for OWC 2017 (see Annexure for details).

Figure 1: Break-up of total carbon emissions from OWC 2017



5.2 Breakup of CO_2 emissions for the three major CO2 contributors to OWC 2017

Table 2 provides a breakup of the energy consumption and CO_2 emissions by sub-activity of the OWC 2017.

The brake up of CO_2 emissions by sub-activity for each of the major CO_2 contributors to OWC 2017 are provided in Figs 2-4.

[6] tonne of oil equivalent is the energy contained in 1 tonne of oil = 11,667 kWh = 42 giga joules

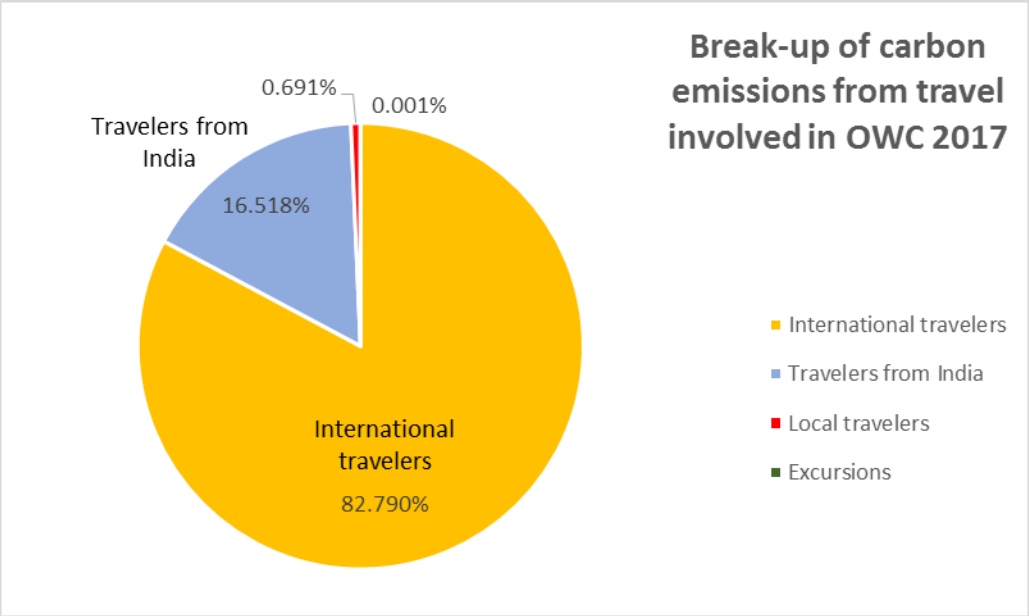
[7] Source: World bank, https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?year_high_desc=false

Table 2: Break-up of energy consumption and CO_2 emissions by sub-activity of OWC 2017[8]

Columns →	1	2	3	4	5
Rows ↓					
1	Heads and sub-heads	Energy consumption (kWh)	Percentage of energy consumption	Carbon emissions (kg CO_2)	Percentage of carbon emissions
2	**Electricity**	**1,72,955**		**1,72,955**	
3	Venue	90,763	53%	90,763	53%
4	Hotel	82,200	48%	82,200	48%
5					
6	**Built-up space**	**15,117**		**7,256**	
7	Venue	7,379	49%	3,542	49%
8	Hotel	7,738	51%	3,714	51%
9					
10	**Travel**	**61,39,448**		**15,50,339**	
11	International travelers	53,32,139	86.9%	12,81,403	82.7%
12	Travelers from India	7,68,297	12.5%	2,56,387	16.5%
13	Local travelers	32,400	0.5%	10,692	0.69
14	Excursions	6,612	0.1%	1,857	0.001%
15					
16	**Delhi infrastructure**	**90,411**		**20,548**	
17					
18	**Organizing the conference**	**10,48,231**		**4,04,601**	
19	Travel for meetings	8,58,993	81.9%	2,15,363	53.2%
20	Office use	1,03,908	9.9%	1,03,908	25.7%
21	Upkeep	85,330	8.1%	85,330	21.1%
22					
23	**Food**	**45,546**		**22,614**	
24	Cooking energy	29,400	64.5%	6,468	28.6%
25	Food items	7,936	17.4%	16,146	71.3%
26					
27	**Consequential events**	**1,51,653**		**50,968**	
28	BIOFAC	16,090	10.6%	15,534	30.5%
30	Travel	1,17,608	77.6%	28,686	56.3%
31	Food	17,955	11.8%	6,748	13.2%
32					
33	**Waste**	**1,412**		**1,412**	
34	Food waste	944	66.9%	944	66.9%
35	Other waste	468	33.1%	468	33.1%
36					
37	**Miscellaneous**	**25,094**		**25,094**	
38	**Carbon footprint study**	**2,375**		**1,010**	
39	Resources	575	24.2%	575	57%
40	Travel	1,800	75.8%	435	43%

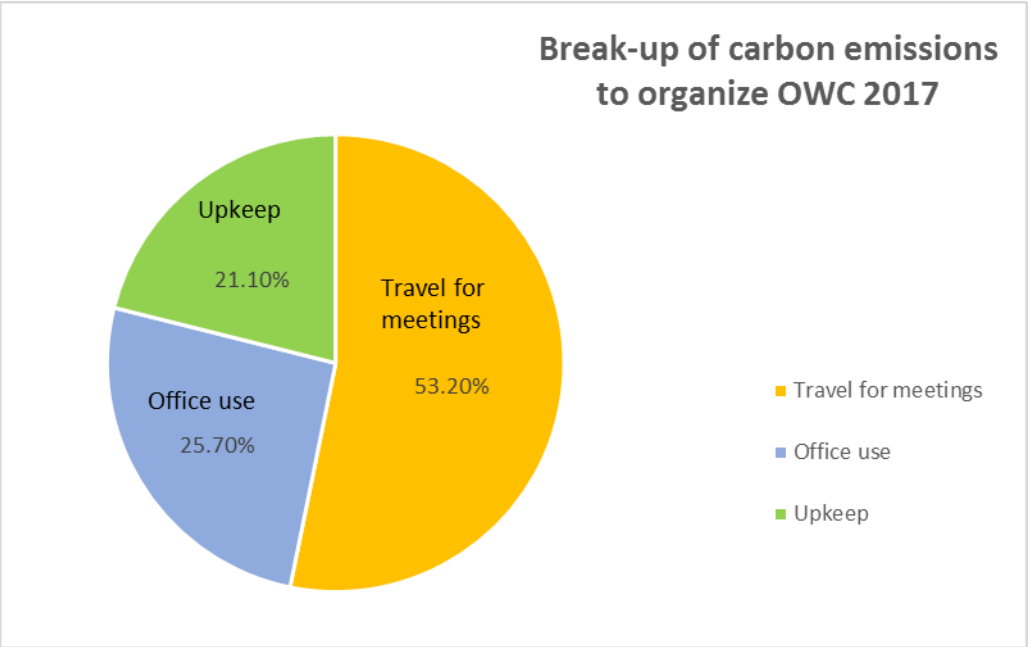
[8] Computed figures are based on data used in the study without the 35% markup as done in Sub-section 5.1 to arrive at the derived energy consumption and CO_2 emissions of OWC 2017.

Figure 2: Break-up of CO_2 emissions by sub-activity for travel to attend the OWC 2017



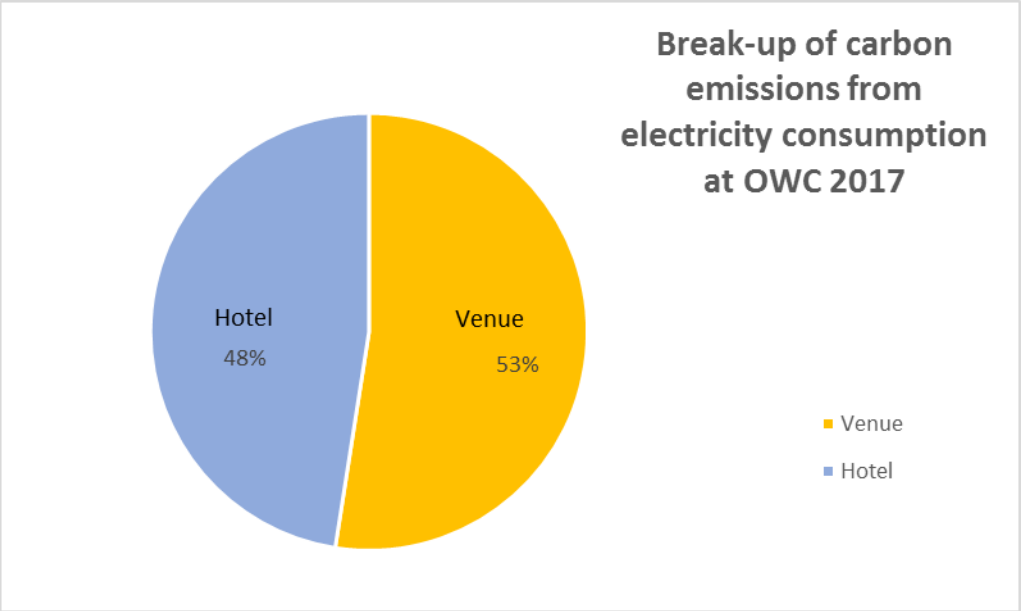
Travel made by international delegates and domestic delegates contributed 83% and 17%, respectively to the CO_2 emissions from all travel made for attending OWC 2017. Carbon emissions from other travel components, e.g., excursions and travel done by volunteers, etc, was comparatively very small.

Figure 3: Break-up of CO_2 emissions by sub-activity for organizing OWC 2017



Travel by OWC organizers contributed a little over half (53%) the CO_2 emitted by all activies undertaken to organize OWC 2017. Emissions for organizers's support and office use contributed about a one-fourth the CO_2 emitted by all activies undertaken to organize OWC 2017.

Figure 4: Break-up of CO_2 emissions from electricity consumption for OWC 2017



Electricity consumption at the conference venue and participant accommodation venues contributed roughly equal amounts of CO_2 emitted due to electricity use for the conference.

6. Energy and carbon emission savings due to measures taken by OWC 2017

OWC 2017 took certain measures to save energy consumption and reduce carbon emissions (see Sub-section 1.3). A computation was made to quantify the saving due to these measures (see Annexure XII for details and Table 3 below for a summary).

Table 3: CO2 emission savings due to measures taken by OWC 2017

Steps OWC 2017 took to reduce carbon emissions	**CO_2 savings due to steps taken by OWC** (t)	**Saving as a percent of total CO_2 emissions** (%)
Bus shuttles	1.51	0.05
Providing organic vegetarian food	1.56	0.05
Reducing plastic cutlery	1.26	0.04
Reducing plastic banners	0.42	0.01
Total	**4.75**	**0.15**

CO_2 emission savings due to measures taken by OWC 2017 are 0.15% of OWC's total emissions

7. Forest area required to sequester OWC 2017 CO_2 emissions

About 151,800 ha·days of forest land or 50,600 ha for each of the three days of the conference, are required for to sequester 3,036 t of CO_2 emitted by OWC 2017[9].

8. Recommendations

Besides the steps taken in OWC 2017, which were very much in the right direction, the following suggestions may be considered to reduce energy and carbon footprint of future OWC conferences and meetings:

- **Reduce travel and shift trip modes:** As conference participant travel was the biggest contributor to the energy and carbon footprint of OWC 2017, attempts may be made to reduce participant travel distances to OWCs, and shift the travel mode from air to surface travel (bus, train, and avoid cars). This can be done by:
    - Holding more regional conferences and meetings
    - Do more web seminars
    - Minimize use of air travel and encourage more surface transport by buses and trains
    - Increase the use of public transport for local travel and discourage use of cabs
    - Reduce the distance between conference venue and participant housing
- **Use less energy intensive conference venues and participant housing:** Use of venues that are less energy intensive and accommodation that is more basic than was provided in OWC 2017 would help in reducing future OWCs' energy and carbon footprint.
- **Reduce conference organizing effort:** Less elaborate conferences will aid in reducing the effort required to organize future OWCs, hence reduce OWCs' energy and carbon footprints. Tasking conference participants (farmers) to take specific responsibilities for organizing the OWC on voluntary basis can reduce the travel for organizing OWCs.
- **Hold conferences in smaller towns:** Large cities like Delhi with their developed infrastructure contribute substantially to the energy and carbon footprint of conferences. To reduce the contribution of the host city's infrastructure to the energy and carbon footprint, the possibility of holding future OWCs in smaller towns that have good accessibility could be explored.

[9] The Western Ghats sequesters on average 7.5 T of CO2 per hectare per year, i.e., 20 kg per day per ha.

- **Dispense with unnecessary materials:** Future OWCs may debate the need for promotional films, carpets, models, etc and dispense with such items that are deemed unnecessary.

- **Increase use of renewable materials:** The use of plastic, metal and goods from non-renewable ores, e.g., cement concrete housing, should be minimized and the increase in the use of renewable materials, e.g., wooden housing and partitions, should be explored.

- **Energy and carbon footprint reduction plans:** Energy and carbon footprint reduction plans should be dovetailed into the planning process of OWC from the beginning. If necessary, external help and expertise may be used to do this.

- **Links with other similar movements:** Realization that the world's natural resources are limited and should be conserved and that overuse of fossil fuels has led to global warming is recent. The organic farming movement is one of the many efforts that attempts to reduce energy consumption and carbon emissions. Such movements will be more effective if they are able to link with each other. The organic farming movement could start doing this by setting up a dialogue with other movements that are closest to it, e.g., the permaculture movement, movements such as those that ask for carbon sequestration compensation for farmers, movements that ask for reducing unequal exchange of energy between the agricultural and industrial sectors, movements that ask for not stopping industrial pollution that impact agricultural adversely, equalizing cumulative risk from all natural and manmade causes between urban and rural areas, equalizing energy entitlements between rural and urban areas.

Annexure I

Data obtained from Organic World Congress (OWC) organizers

Table 1: Conference participants

Participants from	Farmers	Non-farmers
India	805	196
Developing countries in Asia (except India), Africa, South America	377	
Europe, USA, Canada, Australia, New Zealand	330	

Table 2: Distance of accommodation from venue

Distance of accommodation from conference venue	Number of persons
3 km	300

Table 3: Trips made by organizers for organizing the conference

Mode	Trip	Number of trips	Number of persons
Flight			
International	India-Germany-India	5	10
Domestic	Goa-Delhi-Goa	86	2
	Delhi/Goa-Bangalore-Delhi/Goa	168	4
	Bangalore/Goa-Kochi-Bangalore/Goa	10	4
	Delhi/Goa-Bhubaneshwar-Delhi/Goa	12	4
	Bangalore/Goa-Vishakhapatnam-Bangalore/Goa	10	4
	Delhi/Goa-Gangtok-Delhi/Goa	4	4
	Delhi/Bangalore-Lucknow-Delhi/Bangalore	6	2
	Kochi-Pune-Kochi	3	2
	Bangalore-Bhopal-Bangalore	1	1
Train	Delhi-Chandigarh-Delhi	5	2
	Delhi-Lucknow-Delhi	3	3
	Delhi-Goa-Delhi	6	1
	Delhi-Meerut-Delhi	1	2

Table 4: Number of people who worked for two years to organize the conference

Indian	15
Foreign	5

Table 5: Excursions organized for the participants

Trips	Destination	Mode of travel	Number of people
Trip 1	Ramgarh, Uttarakhand	Bus	50
Trip 2	Vadodara, Gujarat	Train	10
Trip 3	Dehradun, Uttarakhand	Bus	50
Trip 4	Dehradun, Uttarakhand	Bus	-

Table 6: Food

Number of people for whom food was prepared at OWC 2017	3,000
Nature of food	Vegetarian

Data obtained from India Exposition Mart Limited (IEML) website

Website URL: *http://indiaexpomart.com/capacity-chart/*

Table 7: Space occupied by conference at IEML

Space	Area (m^2)
Hall 2 (OWC), Hall 6 (State Pavilion), Hall 7 (Dining hall), Banquet 1 (OWC), Banquet 2 (OWC), Common Function Building	18,794
Hall 8 (Inauguration and cultural evening - used only on Day1, hence only one-third area considered)	1,152
Food yard	840
Registration 1	860
Registration 2	25

Table 8: Total available power supply at IEML

From	Power supply (MW)
Grid	18
Solar panel	2

Annexure II

Computations for electricity consumption at conference venue and hotel

Columns → / Rows ↓	1	2	3	4	5	6	7
1	Venue	Number of attendees	Total area used	Power supply	Time of use	Energy consumption	Carbon emissions
2			m^2	kW/m^2	hrs	kWh	kg CO_2
3						Cols 3 x 4 x 5	Col 6 x 1 kg CO_2/ kWh
4		N/A	21,671	0.117	36	90,763	90,763
5	Hotel		Area used per person	Per day energy consumption	Number of days	Energy consumption	Carbon emissions
6			m^2	kWh/ m^2		kWh	kg CO_2
7						Cols 2 x 3 x 4 x 5	Col 6 x 1 kg CO_2/ kWh
8		2,000	7.5	1.096	5	82,200	82,200
9						C6R4 + C6R8	C7R4+C7R8
Total						1,72,955	1,72,955

Total energy consumption due to electricity use: 1,72,955 kWh
Total carbon emissions due to electricity use: 1,72,955 kg CO_2

Notes:

1. Data for total available power supply and space used by the conference has been shared by the organizers. Refer Tables 7 and 8 in Annexure I.
2. C stands for Column and R stands for Row. Cell address is denoted by the format CxRx where x is the number of the referred Column or Row.
3. The research team estimates that on an average, about 7.5 sq.m or 80.7 sq.ft per person is sufficient to accommodate a person comfortably. This area includes bed, luggage space, living space and restroom.
4. Source for energy consumption and carbon emission factors used in Annexures II-XIII are from five energy and carbon footprint calculators developed by Cerana Foundation. These factors are computed from primary Indian data.

Annexure III

Computations for fraction of embodied energy in conference venue and hotel space use attributable the conference and consequently energy consumption and carbon emissions due to space use by conference

Columns → / Rows ↓	1	2	3	4	5	6	7
1	Venue	Number of people	Total area used	Per year built-up space energy consumption	Number of days	Energy consumption	Carbon emissions
			ft^2	kWh		kWh	kg CO_2
				Col 3 x 3.5 kWh/ft^2/yr		Col 4/365 x Col 5	Col 6 x 0.48 kg CO_2/ kWh
2		N/A	233,180	816,130	3	6,708	3,220
Adding 10% to the venue built-up space emissions to account for the parking areas, garden areas, and other such common areas that haven't been included in the list above.							
3						7,379	3,542
4	Hotel		Area used per person	Per person per day energy consumption	Number of days	Energy consumption	Carbon emissions
5			ft^2	kWh		kWh	kg CO_2
6				Col 3 x 3.5 kWh/ft^2/yr		Col 4/365 x Col 5	Col 6 x 0.48 kg CO_2/ kWh
7		2,000	80.7	282.45	5	7,738	3,714
						C6R3+C6R7	C7R3+C7R7
Total						15,117	7,256

Total energy consumption due to use of venue and hotel space: 15,117 kWh
Total carbon emissions due to use of venue and hotel space: 7,256 kg CO_2

Notes:

1. Data for total space used by the conference has been shared by the organizers. Refer Tables 7 in Annexure I.

Annexure IV

Computations for emissions from travel

Table 1: International travelers

Columns → / Rows ↓	1	2	3	4	5	6
1		Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	Home-Home country airport-Home (by Train/Bus/Car)					
4				Col 2 x Col 3	Col 4 x 0.47 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
5	Total number	717	600	430,200	**202,194**	**48,527**
6	Home country airport-Delhi airport-Home country airport (by Flight)					
7				Col 2 x Col 3	Col 4 x 0.38 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
8	Asia (except India), Africa, Latin America	377	17965	6,772,805	**2,573,666**	**617,680**
9	USA, Canada, Europe, Australia, New Zealand	330	19353	6,386,490	**2,426,866**	**582,448**
10	Organizing members*	10	12400	124,000	**47,120**	**11,309**
11	Delhi airport-Hotel-Delhi airport (by Cab)					
12				Col 2 x Col 3	Col 4 x 0.8 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
13	Total number*	717	110	78,870	**63,096**	**15,143**
14	Hotel-Conference venue-Hotel (for 3 days)					
15					Col 4 x 3 x 0.08 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
16	By Shuttle Bus	300	6	1,800	**432**	**104**
17					Col 4 x 3 x 0.30 kWh/pass.km	Col 5 x 0.33 kg CO_2/kWh
18	By Metro/Bus/Cab*	417	50	20,850	**18,765**	**6,192**
					C5R5 + C5R8 + C5R9 + C5R10 + C5R13 + C5R16 + C5R18	C6R5 + C6R8 + C5R9 + C6R10 + C6R13 + C6R16 + C6R18
Total					**5,332,139**	**1,281,403**

Table 2: Travelers from India

Columns → / Rows ↓	1	2	3	4	5	6
1		Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	Home-Home airport or station-Home (by Train/Bus/Car)					
4				Col 2 x Col 3	Col 4 x 0.07 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
5	Farmers	805	100	80500	**5,635**	**1,352**
6	Non-farmers	196	100	19600	**1,372**	**329**
7	Home airport/station-Delhi airport/station-Home airport/station (by Flight/Train/Bus)					
8	Farmers			Col 2 x Col 3	Col 4 x 0.34 kWh/pass.km	Col 5 x 0.31 kg CO_2/ kWh
9	North zone	315	700	220,500	**74,970**	**23,241**
10					Col 4 x 0.20 kWh/pass.km	Col 5 x 0.37 kg CO_2/ kWh
11	East zone	220	3900	858,000	**171,600**	**63,492**
12	South zone	170	5400	918,000	**183,600**	**67,932**
13					Col 4 x 0.19 kWh/pass.km	Col 5 x 0.33 kg CO_2/ kWh
14	West zone	100	1900	190,000	**36,100**	**11,913**
15					Col 4 x 0.35 kWh/pass.km	Col 5 x 0.29 kg CO_2/ kWh
16	Non-farmers	196	3200	627,200	**219,520**	**63,661**
17	Organizing members*	10	3200	32,000	**11,200**	**3,248**
18	Delhi airport/station-Hotel-Delhi airport/station (by Metro/Cab/Bus)					
19	Farmers, Non-Farmers and Organizing members*			Col 2 x Col 3	Col 4 x 3 x 0.30 kWh/pass.km	Col 5 x 0.33 kg CO_2/kWh
20		1,011	92	93,012	**27,904**	**9,208**
21	Hotel-Conference venue-Hotel (for 3 days) (by Metro/Bus/Cab)					
22	Farmers, Non-Farmers and Organizing members*				Col 4 x 3 x 0.30 kWh/pass.km	Col 5 x 0.33 kg CO_2/kWh
23		1,011	40	40,440	**36,396**	**12,011**
					C5R5 + C5R6 + C5R9 + C5R11 + C5R12 + C5R14 + C5R16 + C5R17+ C5R20 + C5R23	C6R5 + C6R6 + C6R9 + C6R11 + C6R12 + C5R14 + C6R16 + C5R17 + C5R20 + C5R23
Total					**768,297**	**256,387**

Table 3: Local travelers

Columns → / Rows ↓	1	2	3	4	5	6
1		Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	By Train/Bus/Car (for 3 days)			Col 2 x Col 3	Col 4 x 3 x 0.30 kWh/pass.km	Col 5 x 0.33 kg CO_2/kWh
4	Local participants, Organizers, Volunteers, Hospitality, Security*	600	60	36,000	**32,400**	**10,692**
Total					**32,400**	**10,692**

Table 4: Excursions

Columns → / Rows ↓	1	2	3	4	5	6
1	Trips	Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	By Bus			Col 2 x Col 3	Col 4 x 0.07 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
4	Trip 1: Ramgarh, Uttrakhand	60	660	39,600	**2,772**	**665**
5	Trip 3: SARG, Dehradun, Uttrakhand	60	500	30,000	**2,100**	**504**
6	Trip 4*: Navdanya, Dehradun, Uttrakhand	20	500	10,000	**700**	**168**
7	By Train			Col 2 x Col 3	Col 4 x 0.026 kWh/pass.km	Col 5 x 0.5 kg CO_2/kWh
8	Trip 2: Vadodara, Gujarat	20	2000	40,000	**1,040**	**520**
					C5R4+C5R5+C5R6+C5R8	C6R4+C6R5+C6R6+C6R8
Total					**6612**	**1857**

Total energy consumption due to travel: 6,139,448 kWh
Total carbon emissions due to travel: 1,550,339 kg CO_2

Notes:

1. Data for number of travelers in Tables 1-4 has been shared by the organizers. Refer Tables 1, 2 and 5 in Annexure I.
2. For each excursion, an additional number of 10 persons has been accounted considering a minimum number of support staff that will accompany the participants on the excursion and the trip.
3. In the absence of information from the organizers' end, numbers for certain heads have been judiciously assumed by the research team. These numbers have been indicated as starred.

Annexure V

Computations for emissions from use of Delhi infrastructure

Table 1: Emissions from use of Delhi infrastructure

Columns → / Rows ↓	1	2	3	4	5	6
1	Number of people	Number of days	Energy factor	Carbon emission factor	Energy consumption	Carbon emissions
2			kWh/person/yr	$kgCO_2$/person/yr	kWh	$kgCO_2$
3					Cols 1 x 2 x 3 /365	Cols 1 x 2 x 3 /365
4	3000	5	2200	500	**90,411**	**20,548**

Total energy consumption due to use of Delhi infrastructure: 90,411 kWh
Total carbon emissions due to use of Delhi infrastructure: 20,548 kg CO_2

Notes:

1. Computations in Table 1 Annexure V account for the use of infrastructure and services provided by the government of Delhi like roads, highways, railways, bridges, dams, airports, health, law & order, and other public amenities.

Annexure VI

Computations for emissions from organizing the conference

Table 1: Emissions from travel for meetings

Columns → / Rows ↓	1	2	3	4	5	6
1	Number of trips	Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	By Flight (international)			Cols 1 x 2 x 3	Col 4 x 0.38 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
4	5	10	12,600	630,000	**239,400**	**57,456**
5	By Flight (domestic)				Col 4 x 0.47 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
6				1,171,780	**550,737**	**132,177**
7	By Train				Col 4 x 0.05 kWh/pass.km	Col 5 x 0.5 kg CO_2/kWh
8				39000	**1,950**	**975**
9	Local travel (by Metro/Cab)				Col 4 x 0.413 kWh/pass.km	Col 5 x 0.37 kg CO_2/kWh
10	360	15	30	162,000	**66,906**	**24,755**
					C5R4 + C5R6 + C5R8 + C5R10	C6R4 + C6R6 + C6R8 + C6R10
Total					**858,993**	**215,363**

Notes:

1. Data from Table 3, Annexure I, has been simplified for the computations presented in Table 1, Annexure V. Detailed data can be shared upon request.

Table 2: Emissions from office use

Columns → / Rows ↓	1	2	3	4	5	6
1	Item	Number	Carbon emissions per unit	Carbon emissions for 480 days	Carbon emissions for 20 people for 480 days	Energy consumption
2			kg CO_2	kg CO_2	kg CO_2	kWh
3	**Personal use items (per person)**	Number (units)				
4	USB drive	1	1.25	1.25	25	
5	Laptop	1	200	200	4,000	
6	Table and chair	1	100	100	2,000	
7	**Common use items**					
8	Microwave oven	1	277.78	277.78	278	
9	Digital Copier	1	2201.11	2201.11	2,201	
10	**Miscellaneous items/services**	Number (per person per month)				
11	Electricity (units)	50	50	1,200	24,000	
12	Drinking water (in litre)	30	0.00028	0.20	4	
13	Flush tank water (in litre)	200	0.00067	3.22	64	
14	Paper (in number of sheets)	10	0.013	3.12	63	
15	Pantry (in kg of food)	10	0.72	172.80	3,456	
16	Toilet roll (in number of rolls)	1	0.73	17.52	350	
17	Tissue paper (in number of boxes)	1	0.73	17.52	350	
18	Tea/coffee (with milk) (in number of cups)	40	0.07	68.16	1,363	
19	Mobile calls (1 hr per day)	20	6.85	3287.67	65,753	
20	**Internet related**	Total number				
21	Email	40,000	0.004		160	
22	Email with attachment	15,000	0.05		750	
23	Google search	100,000	0.0036		360	
24	Servers and networks per hour	3840 working hours	0.05		192	
Total					**105,369**	**105,369**

Notes:

1. There were 15 organizing members in India and 5 in Europe directly involved in organizing the OWC 2017. The organizers worked for 2 years or 24 months to organize the OWC 2017. The computations consider 20 working days in each month and hence, total of 480 working days or 3840 working hours.

Table 3: Emissions from upkeep of organizer team

Columns → / Rows ↓	1	2	3	4	5	6
1	Organizer	Carbon emissions to sustain one organizer	Number of organizers	Number of years	Carbon emissions	Energy consumption
2		kg CO_2			kg CO_2	kWh
3					Cols 2 x 3 x 4	
4	Indian	2011	15	2	60330	
5	German	2500	5	2	25000	
Total					**85,330**	**85,330**

Total energy consumption in organizing the OWC 2017: 1,049,692 kWh
Total carbon emissions from organizing the OWC 2017: 406,062 kg CO_2

Annexure VII

Computations for emissions from food consumption

Table 1: Emissions from cooking energy

Columns → / Rows ↓	1	2	3	4	5	6
1	Number of people	Rate of consumption of LPG	Number of days	Total amount of LPG	Energy consumption	Carbon emissions
		kg/person/day		kg	kWh	kg CO_2
2				Cols 1 x 2 x 3	Col 4 x 16 kWh/kg gas	Col 5 x 0.22 kgCO_2/kWh
3	3000	0.12	5	1838	29400	6468
Total					**29400**	**6468**

Notes:

1. The research team has calculated the rate of LPG consumption as 0.12 kg per person per day.

Table 2: Emissions from food

Columns → / Rows ↓	1	2	3	4	5
1	Number of people	Per day carbon emissions due to food consumption	Per person carbon emissions for 3 days of OWC	Carbon emissions	Energy consumption
2		kg CO_2	kg CO_2	kg CO_2	kWh
3	Meal type: Vegetarian		3 x Col 2	Cols 1 x 3	Col 4 x 2.23 kWh/ kg CO_2
4	Men				
5	2010	0.79	2.38	**4,784**	**10,668**
6	Women				
7	990	0.64	1.91	**1,891**	**4,217**
8	Number of people	Per cup carbon emissions of tea/coffee	Per person carbon emissions for twice a day and 3 days	Carbon emissions	Energy consumption
9		kg CO_2	kg CO_2	kg CO_2	kWh
10			3 x 2 x Col 2	Cols 1 x 3	Col 4 x 1 kWh/ kg CO_2
11	3000	0.07	0.42	**1,260**	**1,260**
12	Number of people	Per liter carbon emissions of drinking water	Per person carbon emissions for 1.5L/day for 3 days	Carbon emissions	Energy consumption
13		kg CO_2	kg CO_2	kg CO_2	kWh
14			3 x 1.5 x Col 2		
15	3000	0.00028	0.00126	**1.26**	**1.26**
				C4R5 + C4R7 + C4R11 + C4R15	C5R5 + C5R7 + C4R11 + C5R15
Total				**7936**	**16,146**

Notes:

1. The research team has assumed two-thirds men (2010) and one-third women (990) in the total mix of 3000 people present to attend the conference.

Total energy consumption by food consumption: 45,546 kWh
Total carbon emissions from food consumption: 14,404 kg CO_2

Annexure VIII

Computations for emissions from consequential events

Table 1: Emissions from electricity and use of built-up space for BIOFAC

Columns → / Rows ↓	1	2	3	4	5	6	7
1	Built-up venue space	Area	Number of hours	Power supplied	Energy consumption due to electricity used	Carbon emission factor	Carbon emissions due to electricity used
2		sq.m	hours	kW/sq.m	kWh	kg CO_2/kWh	kg CO_2
3					Cols 2 x 3 x 4		Cols 5 x 6
4	Hall 4 (BIOFAC)	3456	36	0.12	**14,930**	1	**14,930**
5							
6		sq.ft	Energy consumption factor	Per year built space energy consumption	Energy consumption due to built-up venue space	Carbon emission factor	Carbon emissions due to built-up venue space
7			kWh/sq.ft/yr	kWh/yr	kWh	kg CO_2/kWh	kg CO_2
8				Cols 2 x 3	Col 4 /365 x 3 days		Cols 5 x 6
9		37,187	3.5	130,155	**1070**	0.48	**514**
					C5R4 + C5R9		C5R4 + C5R9
Total					**16,000**		**15,444**

Table 2: Emissions from waste from side-events like BIOFAC

Columns → / Rows ↓	1	2	3	4	5
1	Item	Approximate weight*	Emission factor	Carbon emissions	Energy consumption
2		kg	kg CO_2/kg	kg CO_2	kWh
					Col 4 x 1 kWh/ kgCO_2
3	Paper/cardboard	10	1	10	10
4	Non-recyclable plastic	10	3.5	35	35
5	Recyclable aluminum	10	3	30	30
6	Recyclable steel	10	1	10	10
7	Recyclable glass	10	0.5	5	5
Total				**90**	**90**
TOTAL EMISSIONS FROM BIOFAC				**15,444+90 = 15,534**	**16,000+90 =16,090**

Table 3: Emissions from travel made by participants not as part of OWC proceedings

Columns → / Rows ↓	1	2	3	4	5	6
1	Source-Destination	Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	By AC Multi-Axel Bus			Col 2 x Col 3	Col 4 x 0.08 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
4	Conference venue-Agra-Conference venue	1,800	360	648,000	**51,840**	**12,442**
5	By Metro			Col 2 x Col 3 x 2 days	Col 4 x 0.026 kWh/pass.km	Col 5 x 0.5 kg CO_2/kWh
6	Botanical Garden-Rajiv Chowk-Botanical Garden	1,000	34	68,000	**1,768**	**884**
7	By Cab			Col 2 x Col 3 x 2 days	Col 4 x 0.8 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
8	Conference venue-Connaught Place-Conference venue	500	80	80,000	**64,000**	**15,360**
					C5R4 + C5R6 + C5R8	C6R4 + C6R6 + C6R8
Total					**117,608**	**28,686**

Notes:

1. It is assumed that at least 35% of the total of 3000 conference attendees, that is, 1050 people made a leisure trip to Agra.
2. It is assumed that at least one-third of the total of 3000 conference attendees, that is, 1000 people made a trip on metro till the town center metro station, Rajiv Chowk, for personal reasons.
3. It is assumed that at least a one-sixth of the total of 3000 conference attendees, that is, 500 people made a trip by cab till the town center, Connaught Place, for personal reasons.

Table 4: Emissions from food consumption outside the OWC dining halls

Columns → / Rows ↓	1	2		3		4		5	6
1	Number of people	Per person per day carbon emissions		Number of meals eaten out per day		Per person carbon emissions for 2 days of eating out		Carbon emissions	Energy consumption
2		kg CO_2				kg CO_2		kg CO_2	kWh
3				2 times x 0.5 x Col 1		2 x Col 2 x Col 3		Col 4 (Non-veg + Veg)	Col 5 x 2.23 kWh/ kg CO_2
4	Men								
5		Non-veg	Veg	Non-veg	Veg	Non-veg	Veg		
6	1005	1.03	0.72	1005	1005	2,070	1,447	3,517	
7	Women								
8		Non-veg	Veg	Non-veg	Veg	Non-veg	Veg		
9	495	0.9	0.58	495	495	891	574	1,465	
10									
11								C5R5 + C5R7	
12								4,982	
Adding 10% of the carbon emissions value to account for alcohol and beverages									
Total								**5,481**	**12,195**

Notes:

1. The research team has assumed two-thirds men (1005) and one-third women (495) in the total mix of 3000 people present to attend the conference.
2. It is assumed that at least half of the total of 3000 conference attendees, that is, 1500 people ate out on at least 2 days additionally, apart from the meals provided by the OWC or the accommodation.
3. It is assumed that half the meals eaten out were vegetarian and half were non-vegetarian.
4. Number of meals eaten out per day are assumed to be 2. Hence, one meal can be assumed to be vegetarian and one meal as non-vegetarian.

Table 5: Emissions from cooking energy for additional food

Columns → / Rows ↓	1	2	3	4	5	6
1	Number of people	Rate of consumption of LPG	Number of days	Total amount of LPG	Energy consumption	Carbon emissions
2		kg/person/day		kg	kWh	kg CO_2
3				Cols 1 x 2 x 3	Col 4 x 16 kWh/kg gas	Col 5 x 0.22 kgCO_2/kWh
4	1500	0.12	2	360	5,760	1,267
Total emissions from consequential food consumption = Emissions of food items + Emissions from cooking energy					**17,955**	**6,748**

Total energy consumption by consequential events of OWC 2017: 130,053 kWh
Total carbon emissions from consequential events of OWC 2017: 45,784 kg CO_2

Annexure IX

Computations for emissions from waste generation

Table 1: Emissions from food waste

Columns → / Rows ↓	1	2	3	4	5	6	7
1	Number of people	Average food intake per day per person	Number of days	Total amount of food cooked	Food waste	Carbon emissions	Energy consumption
2		kg		kg	kg	kg CO_2	kWh
3				Cols 1 x 2 x 3	Col 4 x 0.10	Col 4 x 0.9 $kgCO_2/kg$	Col 5 x 1 kWh/ $kgCO_2$
4	3000	1.165	3	10485	1048.5	944	944
Total						**944**	**944**

Table 2: Emissions from other waste

Columns → / Rows ↓	1	2	3	4	5
1	Item	Approximate weight*	Emission factor	Carbon emissions	Energy consumption
2		kg	kg CO_2/kg	kg CO_2	kWh
					Col 4 x 1 kWh/ $kgCO_2$
3	Paper/cardboard	25	1	25	25
4	Non-recyclable plastic	100	3.5	350	350
5	Recyclable aluminum	10	3	30	30
6	Recyclable steel	50	1	50	50
7	Recyclable glass	25	0.5	12.5	12.5
Total				**468**	**468**

Total energy consumption by waste: 1,412 kWh
Total carbon emissions from waste: 1,412 kg CO_2

Note:

1. Carbon emissions of biodegradable cutlery waste is 0 kg CO_2.

Annexure X

Computations for emissions from miscellaneous items used by participants during OWC

Columns → / Rows ↓	1	2	3	4	5	6
1	Item	Number	Carbon emissions per unit	Per day carbon emissions	Carbon emissions for 3 days	Energy consumption for 3 days
2			kg CO_2	kg CO_2	kg CO_2	kWh
3				Col 3 / 365	3 x Col 2 x Col 4	
4	USB drive	2,000	1.25 kg CO_2/yr	0.0034	20	
5	Laptop	1,000	200 kg CO_2/yr	0.55	1,650	
6	Table	500	50 kg CO_2/yr	0.14	10	
7	Chair	5,000	50 kg CO_2/yr	0.14	103	
8					3 x Col 2 x Col 3	
9	Flush tank water (in litre)	9000	0.00067		18	
10	Paper (in sheets)	3000	0.013		117	
11	Toilet roll (in number of rolls)	3000	0.73		6570	
12	Tissue paper (in number of boxes)	3000	0.73		6570	
13	Organic waste shredder machine	1	12		36	
14	Paperback book	10,000	1		10,000	
Total					**25,094**	**25,094**

Total energy consumption by miscellaneous items: 25,094 kWh
Total carbon emissions from miscellaneous items: 25,094 kg CO_2

Annexure XI

Computations for emissions by the carbon footprint study

Table 1: Emissions from use of resources to aid the research work

Columns → / Rows ↓	1	2	3	4	5	6	7
1	Item	Number	Hours of usage per day	Number of work days	Carbon emission factor	Carbon emissions	Energy consumption
					kg CO_2/yr	kg CO_2	kWh
2						Cols 2 x 3 x 4 x Col 5 /365	Col 6 x 1 kWh/ kg CO_2
3	Laptop	2	8	30	200	263	263
4	Mobile phone	2	1	30	1250	206	206
		Number per day			kg CO_2/item	Cols 2 x 4 x 5	Col 6 x 1 kWh/ kg CO_2
6	Email	4		30	0.004	0.48	0.48
7	Email with attachment	2		30	0.05	3	3
8	Google search	20		30	0.0036	2.16	2.16
		Number of persons			Units per person per month	Col 7 x 1 kg CO_2/kWh	Cols 2 x 5
9	Electricity	2			50	100	100
Total						**575**	**575**

Table 2: Emissions from travel

Columns → / Rows ↓	1	2	3	4	5	6
1	Number of trips	Number of people	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	By Flight (domestic)			Cols 1 x 2 x 3	Col 4 x 0.47 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
4	1	1	3,200	3,200	**1,504**	**361**
5	By Cab				Col 4 x 0.8 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
6	1	1	100	100	**80**	**19**
7	2	2	60	240	**192**	**46**
8	By Metro				Col 4 x 0.05 kWh/pass.km	Col 5 x 0.5 kg CO_2/kWh
9	3	2	38	228	**11**	**5.7**
10	By Non-AC Bus				Col 4 x 0.06 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
11	2	2	54	216	**13**	**3**
					C5R4 + C5R6 + C5R7 + C5R9 + C5R11	C6R4 + C6R6 + C6R7 + C6R9 + C6R11
Total					**1,800**	**435**

Total energy consumption by the carbon footprint research: 2,375 kWh
Total carbon emissions from the carbon footprint research: 1,010 kg CO_2

Annexure XII

Computations for carbon emission reductions in OWC

Table 1: Emissions from local travel

Columns → / Rows ↓	1	2	3	4	5	6
1	Number of people	Number of days	Round trip distance per person	Total distance travelled by all participants	Energy consumption	Carbon emissions
2			km	km	kWh	kg CO_2
3	If not OWC 2017 (by Bus/Cab)			Cols 1 x 2 x 3	Col 4 x 0.43 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
4	300	3	60	54,000	16,200	**1,620**
5	OWC 2017 (by Bus)				Col 4 x 0.08 kWh/pass.km	Col 5 x 0.24 kg CO_2/kWh
6	300	3	6	5,400	432	**104**
Savings						**1,516**

Table 2: Emissions from food cutlery waste

Columns → / Rows ↓	1	2	3	4	5
1	Number of people	Number of days	Weight of cutlery	Number of meals/drinks per day	Carbon emissions
2			kg		kg CO_2
3	Meal cutlery				
4	If not OWC 2017		Per meal		Cols 1 x 2 x 3 x 4 x 3.5 kg CO_2/kg
5	3000	3	0.05	3	473
6	OWC 2017				
7	3000	3			0
Savings					**473**
8	Plastic tea/coffee/water cups				
9	Not OWC 2017		Per cup		
10	3000	3	0.005	5	**788**
11	OWC 2017				
12	3000	3			0
Savings					**788**
Total savings					**1,261**

Table 3: Emissions from food

Columns → / Rows ↓	1	2		4		5
1	Number of people	Per person per day carbon emissions		Per person carbon emissions for 3 days		Carbon emissions
2		kg CO_2		kg CO_2		kg CO_2
3	If not OWC 2017			3 x Col 1 x 0.5 x Col 2		Col 4 (Non-veg + Veg)
4	Men					
5		Non-veg	Veg	Non-veg	Veg	
6	2010	1.13	0.79	3416	2388	5,804
7	Women					
8		Non-veg	Veg	Non-veg	Veg	
9	990	0.99	0.64	1470	944	2,414
11						C5R6+ C5R9
12						8,218
13						
14	OWC 2017					6,663
Savings						**1,555**

Table 4: Emissions from exhibition stall supplies

Columns →	1	2	3	4	5
Rows ↓					
1	Item	Average number of stalls in exhibition	Average weight of flex sheet per stall	Total weight of flex	Carbon emissions
2	If not OWC 2017		kg	kg	kg CO_2
4	Flex sheet			Col 2 x Col 3	Col 4 x 3.5 kg CO_2/kg
5		20	6	120	420
6	OWC 2017				
7	Flex sheet	20	0	0	0
Savings					**420**

Total carbon emission savings in OWC 2017: 4,962 kg CO_2

Notes:

1. This sheet computes emissions for the items or processes that would have been used or done if OWC was organized in a conventional way with no environmentally conscious efforts.
2. About 300 participants were accommodated within 3 km of distance from the OWC venue. The emissions from their daily commute between hotel and venue has been presented in Row 16, Table 1, Annexure IV. Table 1 Annexure XII calculates the emissions from the local travel of these 300 participants if they were not accommodated very close to the conference venue. The difference between the two values are the carbon emission savings of the OWC 2017. Similar principle has been applied to all heads in Annexure XII.

Annexure XIII

Final computation values

Table 1: Break-up of energy consumption and carbon emissions of OWC 2017

Columns →	1	2	3	4	5
Rows ↓					
1	Heads and sub-heads	Energy consumption (kWh)	Percentage of energy consumption	Carbon emissions (kg CO_2)	Percentage of carbon emissions
2	**Electricity**	**172,955**		**172,955**	
3	Venue	90,763	53%	90,763	53%
4	Hotel	82,200	48%	82,200	48%
5					
6	**Built-up space**	**15,117**		**7,256**	
7	Venue	7,379	49%	3,542	49%
8	Hotel	7,738	51%	3,714	51%
9					
10	**Travel**	**6,139,448**		**1,550,339**	
11	International travelers	5,332,139	86.9%	1,281,403	82.7%
12	Travelers from India	768,297	12.5%	256,387	16.5%
13	Local travelers	32,400	0.5%	10,692	0.69
14	Excursions	6,612	0.1%	1,857	0.001%
15					
16	**Delhi infrastructure**	**90,411**		**20,548**	
17					
18	**Organizing the conference**	**1,048,231**		**404,601**	
19	Travel for meetings	858,993	81.9%	215,363	53.2%
20	Office use	103,908	9.9%	103,908	25.7%
21	Upkeep	85,330	8.1%	85,330	21.1%
22					
23	**Food**	**45,546**		**22,614**	
24	Cooking energy	29,400	64.5%	6,468	28.6%
25	Food items	7,936	17.4%	16,146	71.3%
26					
27	**Consequential events**	**151,653**		**50,968**	
28	BIOFAC	16,090	10.6%	15,534	30.5%
30	Travel	117,608	77.6%	28,686	56.3%
31	Food	17,955	11.8%	6,748	13.2%
32					
33	**Waste**	**1,412**		**1,412**	
34	Food waste	944	66.9%	944	66.9%
35	Other waste	468	33.1%	468	33.1%
36					
37	**Miscellaneous**	**25,094**		**25,094**	
38	**Carbon footprint study**	**2,375**		**1,010**	
39	Resources	575	24.2%	575	57%
40	Travel	1,800	75.8%	435	43%

Table 2: Total energy consumption and carbon emissions of OWC 2017

Columns →	1	2	3	4	5
Rows ↓					
1	Heads and sub-heads	Energy consumption (kWh)	Percentage of energy consumption	Carbon emissions (kg CO_2)	Percentage of carbon emissions
2	Electricity	1,72,955	2.25	1,72,955	7.69
3	Built-up space	15,117	0.20	7,256	0.32
4	Travel	61,39,448	79.81	15,50,339	68.95
5	Delhi infrastructure	90,411	1.18	20,548	0.91
6	Organizing the OWC	10,48,231	13.63	4,04,601	17.99
7	Food	45,546	0.59	14,404	0.64
8	Consequential events	1,51,653	1.97	50,968	2.27
9	Waste	1,412	0.02	1,412	0.06
10	Miscellaneous	25,094	0.33	25,094	1.12
11	Carbon footprint study	2,375	0.03	1,010	0.04
	TOTAL	**76,92,242**		**22,48,587**	

Table 3: Land area required to sequester the carbon footprint of OWC 2017

Columns →	1	2
Rows ↓		
1	Total carbon emissions (kg CO_2)	Area.days required in Western Ghat forests to sequester the total carbon emissions (Ha.days)
2		Col 1 / 20 kg ha^{-1} day^{-1}
3	22,48,587	112430

Notes:

1. The Western Ghats sequesters on average 7.5 T of CO2 per hectare per year, i.e., 20 kg per day per ha.