



Carbon accounting

For international conferences, based on minimal information

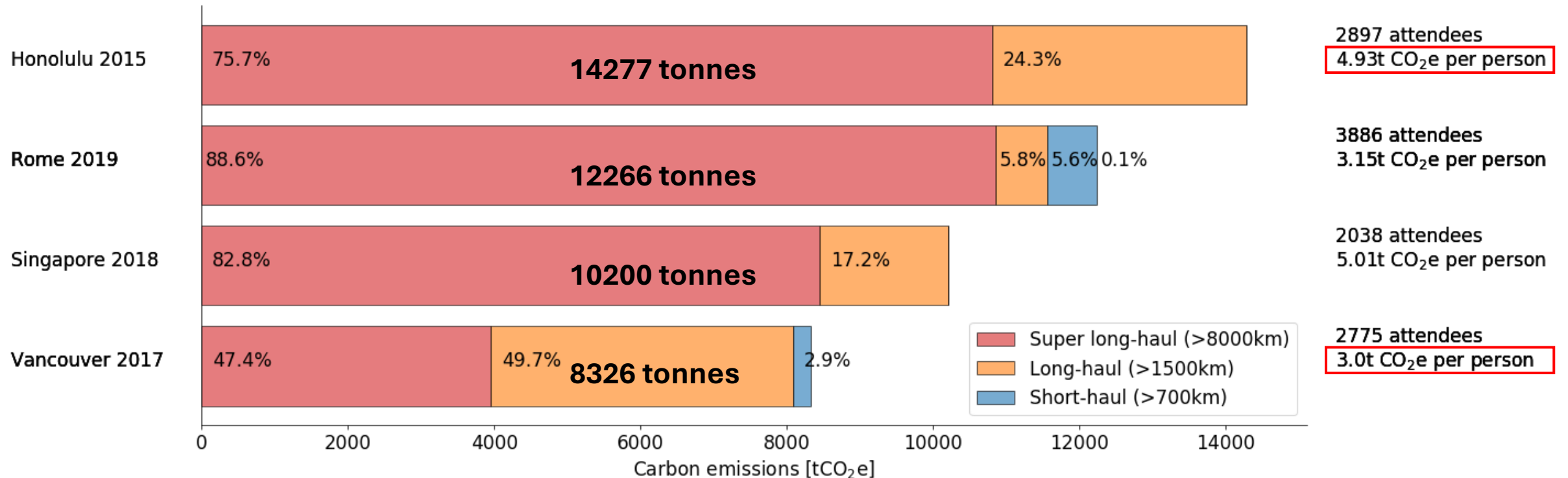
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Emissions due to travel are location-dependent



➤ Aviation/travel to an international conference is the single biggest CO₂e emitter



Epp et al., 2023, Aperture Neuro

→ Total emissions depend on the number of people and the distance attendees have to cover

Results based on harmonized methods



Find script on https://github.com/samiraapp/carbon_accounting_conference

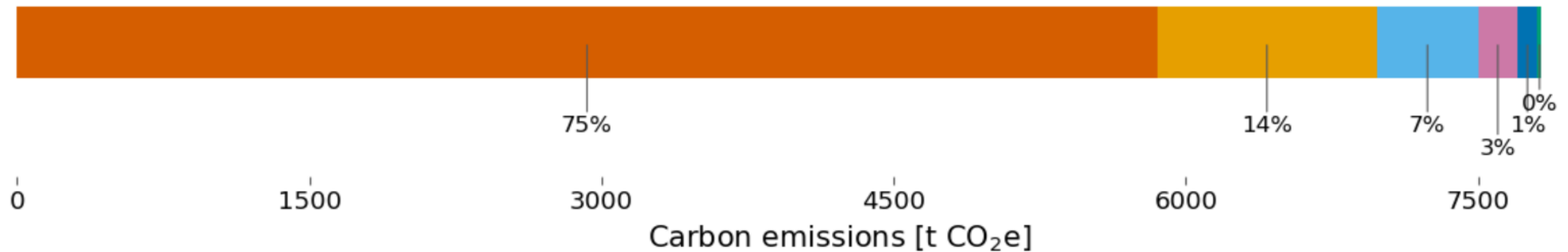
Find UK Government Conversion Factors for greenhouse gas (GHG) reporting 2025 here:

<https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2025>

- Long-haul flights (>8000 km)
- Short-haul flights (1500-8000 km)
- Domestic flights (700-1500 km)
- Train / car / bus (<700 km)
- Hotel nights
- Conference center emissions

Rome 2019

3886 attendees | total emissions: 7826 t CO₂e | 2.01 t CO₂e per person



Rome 2019

88.6%

12266 tonnes

5.8%

5.6%

0.1%

3886 attendees

3.15t CO₂e per person

Hands-on: minimal data needed



AutoSave On Rome_2019_data_exa... Last Modified: Just now

File Home Insert Draw Page Layout Formulas Data Review View Automate Help Acrobat

Clipboard Font Alignment Number Styles Cells Editing Add-ins

STDEV.S $=6371*ACOS(COS(RADIANS(90-SE$2))*COS(RADIANS(90-E3))+SIN(RADIANS(90-SE$2))*SIN(RADIANS(90-E3))*COS(RADIANS(F2-F3)))$

	A	B	C	D	E	F	G	H	I	J	K	L
	Town	Country	Attendees		Latitude	Longitude	RADIANS(angle)					
1	Rom	Italy	147		41.902782	12.496366	0					
2	Buenos Aires	Argentina	3		-34.48297	-58.42305188	$90-SE$2$)					
3	Sydney	Australia	92		-33.83261	151.1887727	16317.577					
4	Wien	Austria	46		48.2118617	16.36382706	764.22915					
5	Region Br	Belgium	89		50.8776303	4.429144546	1172.61709					
6	Brasília	Brazil	21		-15.798785	-47.89573416	8906.2878					
7	Toronto	Canada	130		43.6551998	-79.38121711	7080.7952					
8	Vancouver	Canada	130		49.3153542	-123.0596653	8983.42783					
9	Santiago de	Chile	25		-33.449295	-70.63930671	11908.0843					
10	Peking	China	229		40.0256992	116.4143205	8116.78046					
11	Taipeh	Chinese Taipei	2		25.0478612	121.5776087	9610.18025					
12	Zagreb	Croatia	1		45.815749	15.97982123	516.905598					
13	Republik Z	Cyprus	1		35.0551696	33.21359288	1951.13206					
14	Prag	Czech Republic	21		50.0754523	14.4333455	920.9107					
15	Pjöngjang	Laos	2		39.1446163	125.7842317	8767.55346					
16	Kopenhagen	Denmark	14		55.7222612	12.57227332	1536.66579					
17	Helsinki	Finland	33		60.1992893	24.997173	2205.51716					
18	Paris	France	172		48.8846	2.314358662	1109.40723					
19	Berlin	Germany	399		52.5754632	13.39730156	1188.67005					

- First column: destination
- Location & number of attendees needed.
- Distance calculated via longitude & latitude information

Harmonized methods: assumptions

Plane (distances > 700km)*

- Domestic (between 700 and 1500km) → 0.22928 kg CO₂e/km;
- Short-haul (between 1500 and 8000km) → 0.12786 kg CO₂e/km;
- Long-haul (>8000km) → 0.15282 kg CO₂e/km;

Distances < 700km: car/taxi, bus, rail, ferry

→ Estimated average of 0.06 CO₂e/km & distance multiplied by factor 1.3

Hotel stays*

10.4 kg CO₂e/room-night (UK, different for different countries!)

Conference center emissions**

estimate of 5.25tCO₂e for 1000 people per day = 5.25kg / person / conference day

*based on UK Government Conversion Factors for greenhouse gas (GHG) reporting 2025

<https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2025>

**based on BNA 2025 numbers

Hands-on: python script explained



Find script on https://github.com/samiraapp/carbon_accounting_conference

please update the following section!

```
## please UPDATE PATH!!  
path = '/YOUR/PATH/'  
  
## please update: Length of the meeting (in days)  
n_days = 5  
  
## please update: depending on the length of the conference (n_days), what's the average stay  
n_night = 5  
  
## please update: what are the carbon emission of the conference center per day and participar  
center_CO2 = 5.25  
  
## read excel file, please update filename!  
df = pd.read_excel(path+'Rome_2019_data_example.xlsx', engine='openpyxl')
```

Adjust

- the path where your excel lies
- the number of days & nights of the conference
- carbon emissions of the conference center (if available, if not, leave this estimate)

Hands-on: python script explained



```
#####  
### assumptinos are based on kilometers/distance to conference center  
  
#numbers per scenario: how many people took what kind of flights?  
#Vancouver  
print('Total number of people attending ' + ': ' + str(N_sum))  
ic =sum([N for N,d in zip(N,dist) if d >= 8000])  
people_longhaul_percentage = round(ic/N_sum*100, 1)  
print('long-haul ' + ': '+ str(ic))  
lh = sum([N for N,d in zip(N,dist) if d >= 1500 and d < 8000 ])  
people_shorthaul_percentage = round(lh/N_sum*100, 1)  
print('short-haul ' + ': '+ str(lh))  
sh = sum([N for N,d in zip(N,dist) if d >= 700 and d < 1500])  
people_domestic_percentage = round(sh/N_sum*100, 1)  
print('domestic ' + ': ' + str(sh))  
ra = sum([N for N,d in zip(N,dist) if d < 700])  
people_residence_percentage = round(ra/N_sum*100, 1)  
print('rail/bus/car/ferry ' + ': ' + str(ra))
```

```
Total number of people attending : 3886  
long-haul : 1771  
short-haul : 350  
domestic : 1370  
rail/bus/car/ferry : 395
```

Output: Quick overview over the total number of attendees, and their (assumed) modes of transport

Hands-on: python script explained

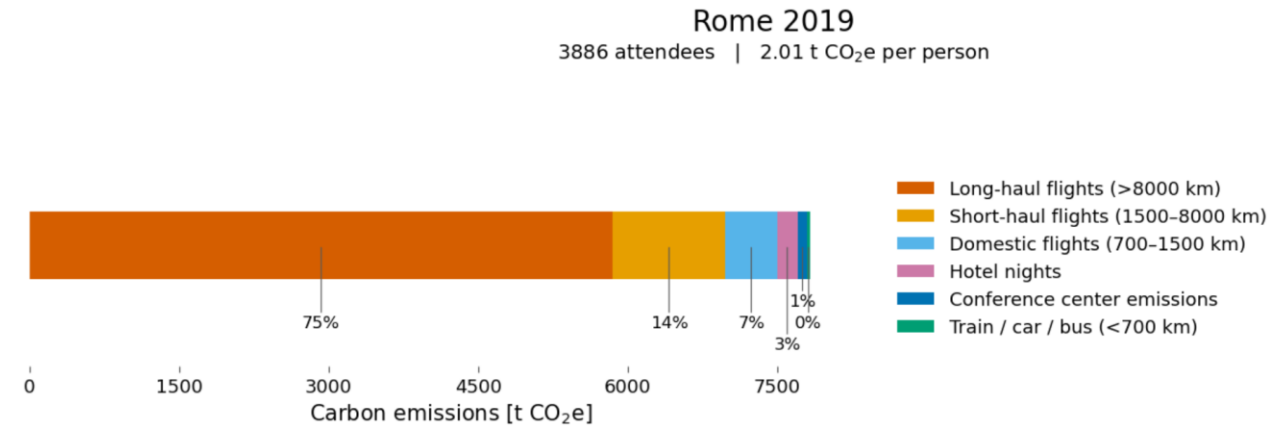


```
dist = np.array(df["Distance"]) #distance in km, one-way
```

```
N = np.array(df["Attendees"]) # how many people
```

```
# -----  
# Calculate emissions  
# -----  
C1lc = sum([num*d*2*0.22028 for num, d in zip(N, dist) if d >= 8000]) / 1000  
C1lh = sum([num*d*2*0.12786 for num, d in zip(N, dist) if d >= 1500 and d < 8000]) / 1000  
C1sh = sum([num*d*2*0.15282 for num, d in zip(N, dist) if d >= 700 and d < 1500]) / 1000  
C1ra = sum([num*d*2*1.3*0.06 for num, d in zip(N, dist) if d < 700]) / 1000  
nights = (N_sum * n_night * 10.4 / 1000)  
conference_CO2 = (N_sum * n_days * center_CO2 / 1000)  
  
values = [C1lc, C1lh, C1sh, C1ra, nights, conference_CO2]  
labels = [  
    "Long-haul flights (>8000 km)",  
    "Short-haul flights (1500-8000 km)",  
    "Domestic flights (700-1500 km)",  
    "Train / car / bus (<700 km)",  
    "Hotel nights",  
    "Conference center emissions"  
]  
  
# Colorblind-safe palette  
colors = ["#D55E00", "#E69F00", "#56B4E9", "#009E73", "#CC79A7", "#0072B2"]  
  
total_emissions = sum(values)  
  
# -----  
# Sort by emissions descending  
# -----  
data = sorted(zip(values, labels, colors), key=lambda x: x[0], reverse=True)
```

Output:



→ Generates graph of total emissions, sorted by % of emissions per category

Hands-on: python script explained



Two plots in one

upper part: total emissions;

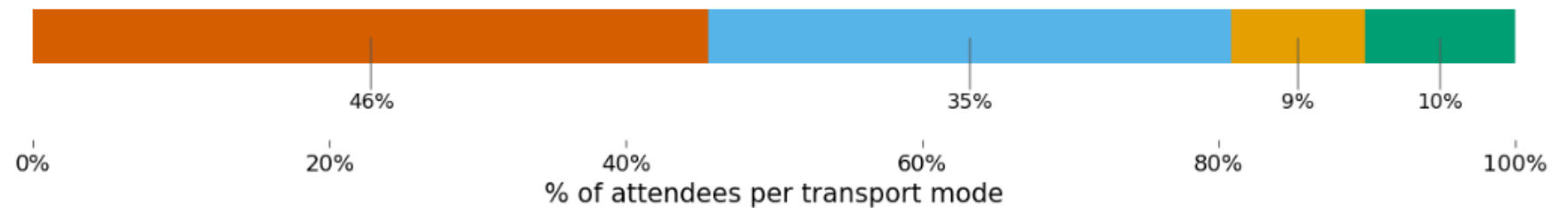
lower part: % of attendees per mode of transport ¶

```
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.ticker import MaxNLocator, PercentFormatter
from matplotlib.patches import Patch

# -----
# Calculate emissions
# -----
C1ic = sum([num*d*2*0.22028 for num, d in zip(N, dist) if d >= 8000]) / 1000
C1lh = sum([num*d*2*0.12786 for num, d in zip(N, dist) if d >= 1500 and d < 8000]) / 1000
C1sh = sum([num*d*2*0.15282 for num, d in zip(N, dist) if d >= 700 and d < 1500]) / 1000
C1ra = sum([num*d*2*1.3*0.06 for num, d in zip(N, dist) if d < 700]) / 1000
nights = (N_sum * n_night * 10.4 / 1000)
conference_CO2 = (N_sum * n_days * center_CO2 / 1000)

values = [C1ic, C1lh, C1sh, C1ra, nights, conference_CO2]
labels = [
    "Long-haul flights (>8000 km)",
    "Short-haul flights (1500-8000 km)",
    "Domestic flights (700-1500 km)",
    "Train / car / bus (<700 km)",
    "Hotel nights",
    "Conference center emissions"
]
```

Output:



→ Second part: how many percent have taken which mode of transport (based on our assumptions)

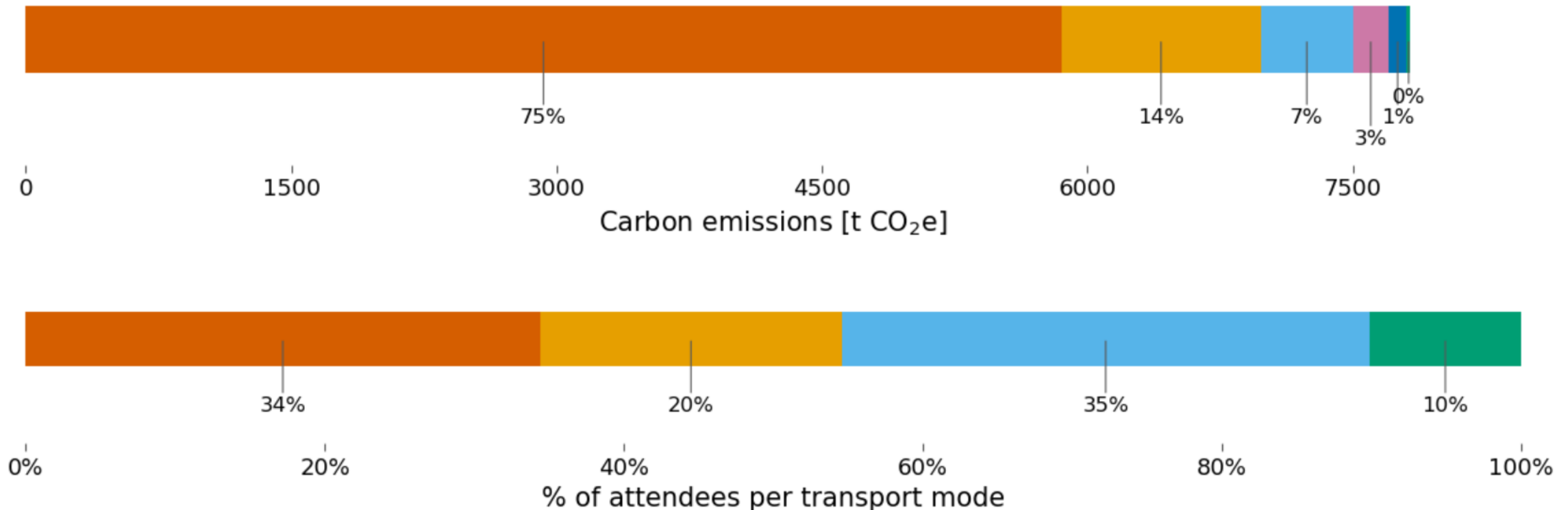
Methods harmonized with the BNA



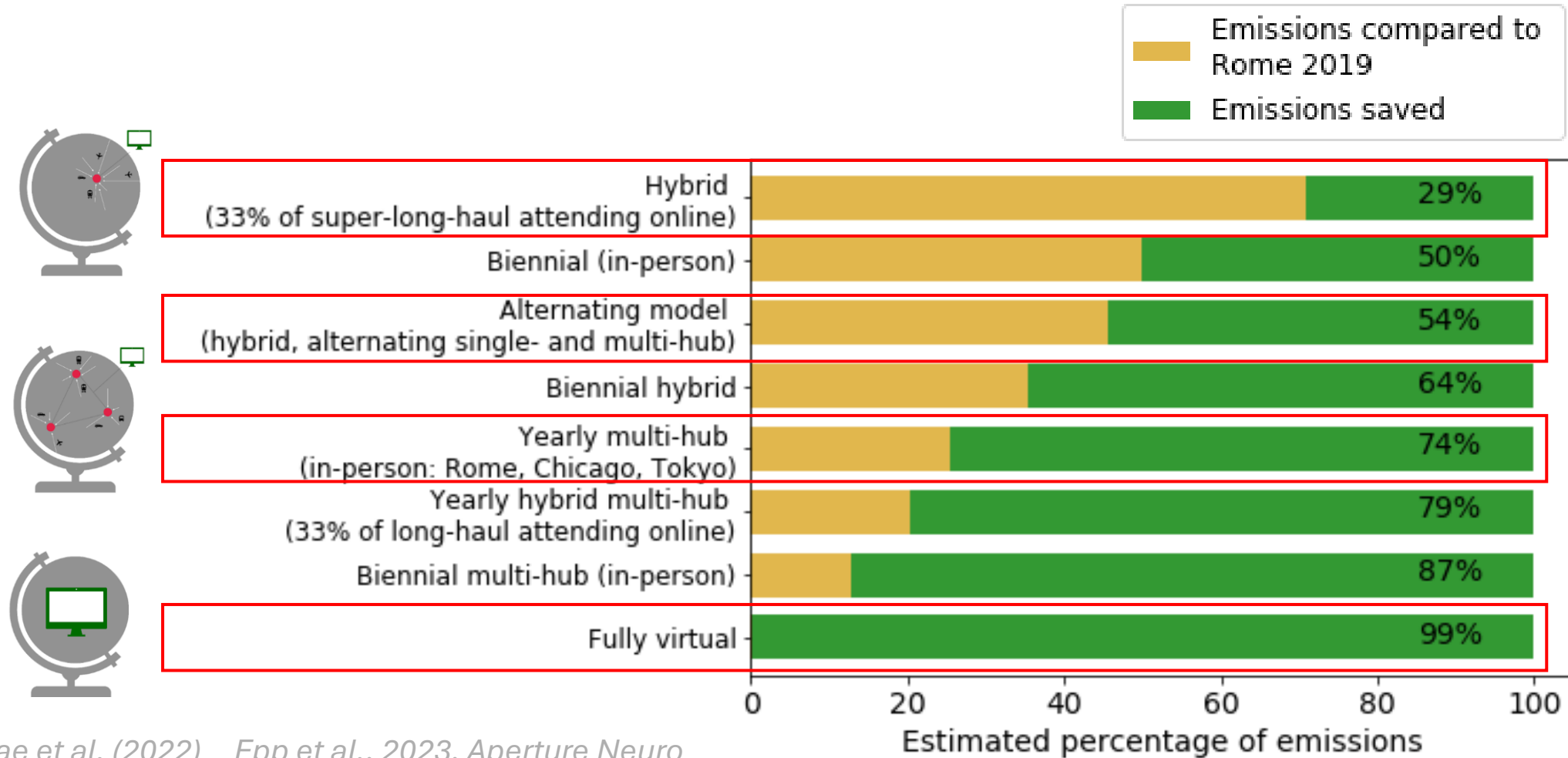
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Alternative conference models



Rae et al. (2022) Epp et al., 2023, Aperture Neuro



Thank you!

And have fun replicating / estimating your own emissions!

https://github.com/samiraepp/carbon_accounting_conference