Methodological note - June 2024

UEFA Euro 2024: which country will champion climate?

Analysis of national teams' travel climate emissions

Foreword

From the 14th of June to the 14th of July, the best national teams in Europe will compete during the UEFA Euro 2024. This competition is a unique opportunity for these teams to shine at the highest level. However, national teams should stand out this summer not only thanks to their sportive performances. By limiting air travel, they could opt for more sustainable ways of travelling, setting an example for the numerous fans who will support their teams in Germany.

T&E evaluated the transport carbon footprint of national teams participating in the UEFA Euro 2024, following two scenarios: teams will travel by plane, or will mostly avoid flying. We calculate transport emissions for the three stages of the competition : travelling from each team's home country to base camps, travelling during the group stage, and for a selection of national teams, travelling during the last step of the competition, the knockout stage.

The following methodological note details how emissions from these different scenarios and different steps of the competition were computed.

1. List of journeys for the UEFA Euro 2024

We divided our analysis in three steps, to account for journeys of teams from their home country to their basecamp in Germany, for journeys during the group stage, and journeys during the knockout stage.

1.1 Travelling from their home country to their basecamp in Germany

Table 1 displays the place of departure of each team in their home country and the location of their basecamp in Germany. The list of base camp locations is accessible on the UEFA Euro 2024 website. The table includes the nearest airports and train stations to their basecamp in Germany.

Team	Capital/Main city	Departing airport	Base camp in Germany	Closest airport	Closest train station
Albania	Tirana	Tirana	Kamen	Dortmund	Kamen
Austria	Vienna	Vienna	Berlin	Berlin	Berlin
Belgium	Brussels	Brussels	Ludwigsburg	Stuttgart	Ludwigsburg
Croatia	Zagreb	Zagreb	Neuruppin	Berlin	Neuruppin
Czechia	Prague	Prague	Norderstedt	Hamburg	Norderstedt
Denmark	Copenhagen	Copenhagen	Freudenstadt	Baden	Freudenstadt

England	Burton upon Trent	Birmingham	Blankenhain	Erfurt	Bad Berka
France	Paris	Paris le bourget	Paderborn	Paderborn	Paderborn
Georgia	Tbilisi	Tbilisi	Velbert	Düsseldorf	Velbert
Germany	Frankfurt	Frankfurt	Herzogenaurach	Nuremberg[1]	Nuremberg
Hungary	Budapest	Budapest	Weiler im Allgäu	Memmingen	Lindau-Reutin
Italy	Florence	Florence	Iserlohn	Dortmund	Iserlohn
Netherlands	Amsterdam	Amsterdam	Wolfsburg	Hannover	Wolfsburg
Poland	Warsaw	Warsaw	Hannover	Hannover	Hannover
Portugal	Lisbon	Lisbon	Harsewinkel	Munster	Rheda
Romania	Bucharest	Bucharest	Würzburg	Nuremberg	Würzburg
Scotland	Edinburgh	Edinburgh	Garmisch-Partenkirchen	Innsbruck	Garmisch-Partenkirchen
Serbia	Belgrade	Belgrade	Augsburg	Memmingen	Augsburg
Slovakia	Bratislava	Bratislava	Mainz	Frankfurt	Mainz
Slovenia	Ljubljana	Ljubljana	Wuppertal	Düsseldorf	Wuppertal
Spain	Madrid	Madrid	Donaueschingen	Zurich	Donaueschingen
Switzerland	Bern	Zurich	Stuttgart	Stuttgart	Stuttgart
Türkiye	Istanbul	Istanbul	Barsinghausen	Hannover	Barsinghausen
Ukraine	Kyiv	Kyiv	Wiesbaden	Frankfurt	Wiesbaden

Table 1: List of departure and arrival points for each team while going to Germany

1.2 Travelling during the group stage

Table 2 displays the departure and arrival points for each team for their three group stage games. Each team's match venues during the group stage are available on the UEFA Euro 2024 website. The closest airports and train stations to the base camps are included for each team. Note that if the travel time by road was less than 2 hours, we considered that the team will likely not take the plane. This choice in our analysis is supported by the fact that the Portuguese federation communicated to T&E members that the Portuguese national team will travel by

[1] Germany will not fly during the first part of the competition, but we did calculate plane emissions for their journeys, to calculate how much CO_2e they save by switching from air to rail or coach

coach for two of their group stage matches in Dortmund and Gelsenkirchen. The journeys between their basecamp in Harsewinkel and these two venues are below 2 hours by coach.

Team	Match	Basecamp	Depart airport	Closest departing station	Game venue	Arrival airport
Albania	1	Kamen	/	Kamen	Dortmund	/
Albania	2	Kamen	Dortmund	Kamen	Hamburg	Hamburg
Albania	3	Kamen	/	Kamen	Düsseldorf	/
Austria	1	Berlin	Berlin	Berlin	Düsseldorf	Düsseldorf
Austria	2	Berlin	/	Berlin	Berlin	/
Austria	3	Berlin	/	Berlin	Berlin	/
Belgium	1	Ludwigsburg	Stuttgart	Ludwigsburg	Frankfurt	Frankfurt
Belgium	2	Ludwigsburg	Stuttgart	Ludwigsburg	Cologne	Cologne
Belgium	3	Ludwigsburg	/	Ludwigsburg	Stuttgart	/
Croatia	1	Neuruppin	/	Neuruppin	Berlin	/
Croatia	2	Neuruppin	Berlin	Neuruppin	Hamburg	Hamburg
Croatia	3	Neuruppin	Berlin	Neuruppin	Leipzig	Leipzig
Czechia	1	Norderstedt	Hamburg	Norderstedt	Leipzig	Leipzig
Czechia	2	Norderstedt	/	Norderstedt	Hamburg	/
Czechia	3	Norderstedt	/	Norderstedt	Hamburg	/
Denmark	1	Freudenstadt	/	Freudenstadt	Stuttgart	/
Denmark	2	Freudenstadt	Baden	Freudenstadt	Frankfurt	Frankfurt
Denmark	3	Freudenstadt	Baden	Freudenstadt	Munich	Munich
England	1	Blankenhain	Erfurt	Bad Berka	Gelsenkirchen	Düsseldorf
England	2	Blankenhain	Erfurt	Bad Berka	Frankfurt	Frankfurt
England	3	Blankenhain	Erfurt	Bad Berka	Cologne	Cologne
France	1	Paderborn	Paderborn	Paderborn	Düsseldorf	Düsseldorf
France	2	Paderborn	Paderborn	Paderborn	Leipzig	Leipzig
France	3	Paderborn	/	Paderborn	Dortmund	/

Georgia	1	Velbert	/	Velbert	Dortmund	/
Georgia	2	Velbert	Düsseldorf	Velbert	Hamburg	Hamburg
Georgia	3	Velbert	/	Velbert	Gelsenkirchen	/
Germany	1	Herzogenaurach	Nuremberg	Nuremberg	Munich	Munich
Germany	2	Herzogenaurach	Nuremberg	Nuremberg	Stuttgart	Stuttgart
Germany	3	Herzogenaurach	Nuremberg	Nuremberg	Frankfurt	Frankfurt
Hungary	1	Weiler im Allgäu	Memmingen	Lindau-Reutin	Cologne	Cologne
Hungary	2	Weiler im Allgäu	Memmingen	Lindau-Reutin	Stuttgart	Stuttgart
Hungary	3	Weiler im Allgäu	Memmingen	Lindau-Reutin	Stuttgart	Stuttgart
Italy	1	Iserlohn	/	Iserlohn	Dortmund	/
Italy	2	Iserlohn	/	Iserlohn	Gelsenkirchen	/
Italy	3	Iserlohn	Dortmund	Iserlohn	Leipzig	Leipzig
Netherlands	1	Wolfsburg	Hannover	Wolfsburg	Hamburg	Hamburg
Netherlands	2	Wolfsburg	Hannover	Wolfsburg	Leipzig	Leipzig
Netherlands	3	Wolfsburg	Hannover	Wolfsburg	Berlin	Berlin
Poland	1	Hannover	/	Hannover	Hamburg	/
Poland	2	Hannover	Hannover	Hannover	Berlin	Berlin
Poland	3	Hannover	Hannover	Hannover	Dortmund	Dortmund
Portugal	1	Harsewinkel	Munster	Rheda	Leipzig	Leipzig
Portugal	2	Harsewinkel	/	Rheda	Dortmund	/
Portugal	3	Harsewinkel	/	Rheda	Gelsenkirchen	/
Romania	1	Würzburg	Nuremberg	Würzburg	Munich	Munich
Romania	2	Würzburg	Nuremberg	Würzburg	Cologne	Cologne
Romania	3	Würzburg	/	Würzburg	Frankfurt	/
Scotland	1	Garmisch-Partenkirchen	/	Garmisch-Partenkirchen	Munich	/
Scotland	2	Garmisch-Partenkirchen	Innsbruck	Garmisch-Partenkirchen	Cologne	Cologne
Scotland	3	Garmisch-Partenkirchen	Innsbruck	Garmisch-Partenkirchen	Stuttgart	Stuttgart

Serbia	1	Augsburg	Memmingen	Augsburg	Gelsenkirchen	Düsseldorf
Serbia	2	Augsburg	/	Augsburg	Munich	/
Serbia	3	Augsburg	/	Augsburg	Munich	/
Slovakia	1	Mainz	/	Mainz	Frankfurt	/
Slovakia	2	Mainz	Frankfurt	Mainz	Düsseldorf	Düsseldorf
Slovakia	3	Mainz	/	Mainz	Frankfurt	/
Slovenia	1	Wuppertal	Düsseldorf	Wuppertal	Stuttgart	Stuttgart
Slovenia	2	Wuppertal	Düsseldorf	Wuppertal	Munich	Munich
Slovenia	3	Wuppertal	/	Wuppertal	Cologne	/
Spain	1	Donaueschingen	Zurich	Donaueschingen	Berlin	Berlin
Spain	2	Donaueschingen	Zurich	Donaueschingen	Gelsenkirchen	Düsseldorf
Spain	3	Donaueschingen	Zurich	Donaueschingen	Düsseldorf	Düsseldorf
Switzerland	1	Stuttgart	Stuttgart	Stuttgart	Cologne	Cologne
Switzerland	2	Stuttgart	Stuttgart	Stuttgart	Cologne	Cologne
Switzerland	3	Stuttgart	Stuttgart	Stuttgart	Frankfurt	Frankfurt
Türkiye	1	Barsinghausen	/	Barsinghausen	Dortmund	/
Türkiye	2	Barsinghausen	/	Barsinghausen	Dortmund	/
Türkiye	3	Barsinghausen	Hannover	Barsinghausen	Hamburg	Hamburg
Ukraine	1	Wiesbaden	Frankfurt	Wiesbaden	Munich	Munich
Ukraine	2	Wiesbaden	Frankfurt	Wiesbaden	Düsseldorf	Düsseldorf
Ukraine	3	Wiesbaden	Frankfurt	Wiesbaden	Stuttgart	Stuttgart

Table 2: List of departure and arrival points for each team during the group stage

1.3 Travelling during the knockout stage

For 6 teams participating in the competition, England, France, Germany, Spain, Portugal and Belgium, we estimated their travel emissions during the knockout stage, to depict a scenario where they would finish first of their group and reach the final in Berlin on July 14th. We selected these 6 teams based on odds of winning the competition, available on several sport betting

websites[2], and because these 6 teams are distributed among the 6 groups from the group stage.

Table 3 displays departure and arrival points for each team for their potential games during the knockout stage. The games venues during the knockout stage are available on the UEFA Euro 2024 website. The closest airports and train stations to their base camps are included for each team. Note that if the travel time by road was less than 2 hours, we considered that the team will likely not take the plane.

Team	Stage	Base camp	Closest departing station	Depart airport	Game venue	Arrival airport
England	Round of 16	Blankenhain	Bad Berka	Erfurt	Gelsenkirchen	Düsseldorf
England	Quarter	Blankenhain	Bad Berka	Erfurt	Düsseldorf	Düsseldorf
England	Semi	Blankenhain	Bad Berka	Erfurt	Dortmund	Dortmund
England	Finale	Blankenhain	Bad Berka	Erfurt	Berlin	Berlin
France	Round of 16	Paderborn	Paderborn	Paderborn	Leipzig	Leipzig
France	Quarter	Paderborn	Paderborn	Paderborn	Berlin	Berlin
France	Semi	Paderborn	Paderborn	/	Dortmund	/
France	Finale	Paderborn	Paderborn	Paderborn	Berlin	Berlin
Germany	Round of 16	Herzogenaurach	Nuremberg	Nuremberg	Dortmund	Dortmund
Germany	Quarter	Herzogenaurach	Nuremberg	Nuremberg	Stuttgart	Stuttgart
Germany	Semi	Herzogenaurach	Nuremberg	Nuremberg	Munich	Munich
Germany	Finale	Herzogenaurach	Nuremberg	Nuremberg	Berlin	Berlin
Spain	Round of 16	Donaueschingen	Donaueschingen	Zurich	Cologne	Cologne
Spain	Quarter	Donaueschingen	Donaueschingen	/	Stuttgart	/
Spain	Semi	Donaueschingen	Donaueschingen	Zurich	Munich	Munich
Spain	Finale	Donaueschingen	Donaueschingen	Zurich	Berlin	Berlin
Portugal	Round of 16	Harsewinkel	Rheda	Munster	Frankfurt	Frankfurt
Portugal	Quarter	Harsewinkel	Rheda	Munster	Hamburg	Hamburg
Portugal	Semi	Harsewinkel	Rheda	Munster	Munich	Munich
Portugal	Finale	Harsewinkel	Rheda	Munster	Berlin	Berlin

[2] betclic.be; bwin.com and winamax.fr. The odds were checked on the 8th of May 2024.

Belgium	Round of 16	Ludwigsburg	Ludwigsburg	Stuttgart	Munich	Munich
Belgium	Quarter	Ludwigsburg	Ludwigsburg	Stuttgart	Berlin	Berlin
Belgium	Semi	Ludwigsburg	Ludwigsburg	Stuttgart	Dortmund	Dortmund
Belgium	Finale	Ludwigsburg	Ludwigsburg	Stuttgart	Berlin	Berlin

Table 3: List of departure and arrival points for selected teams during the knockout stage

1.4 Travelling scenarios

We considered two scenarios: teams will travel by plane, or teams will mostly avoid flying. For journeys from team's home country to their respective basecamp in Germany, we considered an 8 hours threshold, as this duration corresponds to T&E's travel policy as part of our Travel Smart campaign[3].The two scenarios are summarised in table 4.

Scenario	**1 - Air travel**	**2 - Overall switch from air to rail or road**
What the scenario is depicting	Teams will mostly travel by plane	Teams will avoid planes, except for really long trips (typically, to go from their home country to their base camp)
Modal shift threshold	We considered that for short trips (< to 2 hours by road) teams will likely not use the plane. If the trip was < 2 hours and a half, we checked the duration to travel from the basecamp to the airport by coach, and if it was close to one hour, we considered that it was not worthy for the team to take the plane	Long trips (> 8 hours by road) were considered too long for teams to still be undertake by coach or train, and were considered using planes

Table 4: Explanation of travel scenarios

[3] Find out more about the Travel Smart campaign here

2.Calculating CO_2 and CO_2e emissions

2.1 Air travel

Based on information found in the press, it appears that national football teams tend to charter flights when they need to travel by plane[4]. For instance, when departing for Doha during the last World Cup, France used an Airbus A321neo from the carrier La Compagnie[5]. During the same competition, England flew to Qatar using an Airbus A350 from Virgin Atlantic[6].

To not rely on arbitrary choice of a single aircraft model for our analysis, we selected 6 different aircraft models, close to the type of aircrafts previously used by football teams in the aforementioned sources. To select these 6 aircrafts types, we looked for the most frequently used aircraft models in Europe in 2023 using OAG schedule flights data[7]: Airbus A319, Airbus A320, Airbus A320neo, Airbus A321, Airbus A321neo, Boeing 737-800 (winglets) Passenger. Small aircrafts, such as ATR 72 were not included in the analysis.

It is important to note that the list of arriving and departing airports that we used in our analysis was adapted to only include airports where these types of aircrafts were recorded to land or take off in OAG schedule data.

Aircraft emissions were estimated by calculating fuel consumption of each aircraft between departure and arrival airports, to which we applied the emission factor of kerosene. Fuel consumption from aircraft was calculated following Eurocontrol's fuel consumption methodology. Aircraft emissions were then multiplied by two to account for the return journey after the end of the competition.

Aviation's impact on climate is not limited to CO_2 emissions alone[8]. Other gases, such as nitrogen oxides, or contrails formed by aircrafts also have an effect on global climate warming[9]. To account for these non-CO_2 effects, we chose to convert from CO_2 emissions to an estimate of aviation's full climate impact using the mean global warming potential over a time scale of 100 years (GWP100) with a value of 1.7 given by Lee *et al.* (2021). While the climate impact of intra-EU flights may potentially be slightly lower than the global average, we believe this to be a conservative estimate as the global warming potential predicts a higher non-CO2 impact of aviation on shorter time scales.

Once we accounted for non CO_2 effects, we calculated the average climate impact for the 6 aircraft types to estimate CO_2e emissions for a hypothetical air travel journey during the UEFA Euro 2024.

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[4] Source: simpleflying.com
[5] Source: Agence France Presse
[6] Source: itv.com
[7] https://www.oag.com/
[8] Find out more about aviation pollution on T&E website
[9] Lee *et al.*, 2021, Atmospheric Environment (224). Data for contribution of global aviation to anthropogenic climate forcing can be accessed here.

In our analysis, we did not account for coach travelling from the basecamp to the airport, and from the airport to the stadium where the game will take place, as this would have accounted for 0.5% more emissions during the group stage, and we considered this amount negligible.

2.2 Coach travel

To estimate coach travel emissions, we calculated road distances between arrival and departure points using Google maps for each journey included in our analyses. To these distances, we applied coaches emissions factors from T&E's EU Transport Roadmap Model (EUTRM)[10]. These factors are displayed in table 4. Note that for each team, we considered that the coach they may use for travel would originate from their home country. Emissions calculated for each journey were then multiplied by 2 to account for the return trip to the base camp after each game.

Country	**CO_2 emissions per coach ($g.km^{-1}$)**	**Country**	**CO_2 emissions per coach ($g.km^{-1}$)**
Albania	821.11	Poland	836.81
Austria	633.47	Portugal	892.17
Belgium	672.82	Romania	1025.35
Croatia	658.20	Serbia	840.24
Czechia	672.82	Slovakia	672.82
Denmark	672.82	Slovenia	658.20
France	826.33	Spain	838.01
Georgia	826.60	Switzerland	672.82
Germany	827.16	Türkiye	817.57
Hungary	781.73	Ukraine	826.60
Italy	917.70	United Kingdom	812.90
Netherlands	706.60		

Table 5: Emissions factors for coaches. Source: T&E's EUTRM

[10] See annex 4 from T&E's study

2.3 Rail travel

To estimate rail travel emissions, we first checked train itineraries between arrival and departure points for each journey of all teams using Google maps (Transit mode). Then, we transposed each itinerary to bikerouter.de[11], and calculated the distances by setting the user profile to rail. For trains, emissions are calculated in g of CO_2 per passenger per kilometer (see table 6). For each team, we therefore multiplied train emissions by the number of supposed passengers by teams. The UEFA allows teams to bring up to 26 players[12]. In addition, a number of team staff will be travelling with the players. Using team staff composition on transfertmarkt.com and on national teams websites, we estimated that on average, staff would be composed of 20 people during the tournament this summer, for a total of 46 people travelling per team[13]. For each team, emissions were multiplied by two to account for the return journey to the base camp after each fixture.

Country (Operator)	**g of CO_2 per passenger-Km**	**Source**
Austria (ÖBB)	5.7	ÖBB
Belgium (SNCB)	48.4	Mobilité Wallonie
Eurostar	6.68	Eurostar
France (SNCF - TGV)	2.36	ADEME
Germany (DB)	33	Umweltbundesamt
Spain (Renfe)	31	Renfe - annual report 2022
General EU emissions factor	8.3	EEA

Table 6: Emissions factors for trains

In our analysis, we did not account for coach travelling from the basecamp to the train station, and from the station to the stadium where the game will take place, as this would have accounted for 2.6% more emissions during the group stage, and we considered this amount negligible. We did however account for time of travel by coach between base camps or stadiums and train stations to estimate the duration of the complete journey between basecamps and stadiums.

[11] https://bikerouter.de/
[12] See UEFA website
[13] See examples for Germany, France, and Spain

2.4. Estimating transport's carbon footprint for players

For the 6 teams leading the odds of winning the tournament, once we computed all CO_2 emissions for each scenario, we calculated their potential total emissions if they would reach the final of the competition. This total emissions per team, was then divided by the number of people per team (players and staff, see the previous section for the estimation of staff personnel), to obtain the carbon footprint for transport for each player during a month of competition. This amount was then compared to the average monthly CO2 emissions per capita in Europe, which is 0.45 t of CO_2[14].

Further information

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[14] Source: iea.org