



## Carbon footprint of tourism in Barcelona

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### ABSTRACT

This study evaluates the carbon footprint (CF) of Barcelona tourist activity taking into account the above 30 million visitors who visit the city every year. This study analyzes the main sources of emissions considering direct (Scope 1) and indirect emissions (Scope 2 and 3) as a consequence of energy use. This research has been carried out in close collaboration with Barcelona City Council and in the context of the new Strategic Tourism Plan for Barcelona city. The impacts of arrival and departure transport, accommodation, leisure and professional activities and Intra-urban transport from Barcelona city were all included. The total CF of Barcelona tourist activity is about 9.6MtCO<sub>2</sub>eq/year, which represents an emission of 96.9 kg CO<sub>2</sub>eq/visitor-day. The main source of emissions is arrival and departure transport (95.6%), and particularly aviation. These results show that if substantial reductions in CO<sub>2</sub> emissions are to be achieved, initiatives strategically focused on transport and also accommodation are necessary.

### 1. Introduction

In the 2003 Djerba Declaration, the World Tourism Organization (WTO) recognized the bi-directional relationship between tourism and climate change. On the one hand, climate change has an impact on tourist destinations and tourist flows. On the other hand, tourism is a major contributor to climate change mainly due to the use of fossil fuels that leads to the emission of greenhouse gases (GHG). Currently, the tourism industry accounts for more than 9% of global GDP (UNWTO, 2015).

#### 1.1. The importance of tourism on global greenhouse gas emissions

Tourism is a collection of social and economic activities with high energy and carbon intensity and in expansion, for those reasons its effect on climate change is expected to grow considerably in the future. That is why international organizations such as the UN World Tourism Organization (UNWTO), the United Nations Environment Program (UNEP) and the Organization for Economic Co-operation and Development (OECD) are already studying the impact of tourism on climate change.

According to a recent study (Lenzen et al., 2018), between 2009 and

2013, tourism's global carbon footprint has increased from 3.9 to 4.5 Gt CO<sub>2</sub> eq, four times more than previously estimated, accounting for about 8% of global greenhouse gas emissions. That emissions may be higher, up to 14%, if we include radiative forcing, i.e. the warming caused by CO<sub>2</sub> and other greenhouse gases emitted by planes in the stratosphere (WTO, WMO, & UNEP, 2008).

To understand the magnitude of these numbers it should be noted that if we compare national carbon emissions with tourism emissions, tourism would be the 5th largest polluter worldwide. In addition, by 2035, emissions from tourism in absolute terms are expected to be more than double that of 2005. Most of this growth is associated with increased air traffic (WTO, WMO, & UNEP, 2008). In this context, the distance to the destination and the choice of transport for getting there and back are the most important decisions.

#### 1.2. Main contributing touristic activities

Long distance trips by plane amount globally for less than 3% of all trips but they cause 70% of the harmful emissions connected to tourism (Grimm, Beer, Günther, & Weerts, 2008). According to UNWTO, an average holiday trip (considering that in average a tourist trip, which includes international and a big share of domestic touristic trips, lasts

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4.15 days) causes 0.25 tons of CO<sub>2</sub> eq per person.

The contribution of tourism to GHG emissions is particularly significant for those destinations where tourists overwhelmingly arrive by air (Dwyer, Forsyth, Spurr, & Hoque, 2010). Gössling (2013) reports that in the Caribbean islands, the share of emissions related to air travel was between 44% and 70% of total emissions across the region. On Haiku City in China, for example, it was found that transportation CO<sub>2</sub> emissions of airplane travel was 88% of total city tourism transportation and it represented 24% of the city's total emissions (Pu & Mi, 2016). Another study about the energy flows of tourism in Menorca Island shows that air travel contributes the most (77%) to total emissions (Sanyé-Mengual et al., 2014).

Filimonau, Dickinson, and Robbins (2014) conducted a study about the carbon impact of short-haul tourism and they support the idea that transportation generates the largest carbon footprint, showing that the most significant carbon savings can be achieved by switching from air and car-based travel to train and coach journeys. Peeters and Schouten (2006) worked on the ecological footprint of inbound tourism and transport to Amsterdam, and they conclude that the main part of the environmental pressure of inbound tourism originates from transport (70%) and accommodation (21%) (Gössling, 2013; Filimonau et al., 2014).

Although transport is recognized as the highest contributor, many other tourism related activities contribute significantly to tourism GHG emissions because of their high energy intensity, and particularly accommodation and leisure activities. When considering tourist accommodation there are factors that take place on the same premises such as heating, air-conditioning and the maintenance of bars, restaurants, pools, laundry and so on that must be taking in to account (Michailidou, Vlachokostas, Moussiopoulos, & Maleka, 2015).

Usually accommodations of higher category present more services that are closely linked to a larger environmental impact (Accor hotels, 2011). A comparative study realized in a Canary Islands shown that the higher star-rated hotels have consumption levels and emissions triple those of lower star-rated ones, and five times that of the lowest (Díaz Pérez et al., 2018). The electricity consumption makes a significant contribution to the environmental profile of five-star hotel categories, and represents more than 50% of their total greenhouse gas emissions (Puig et al., 2017). Becken, Frampton, and Simmons (2001), underline the importance of accommodation as a source of carbon dioxide emissions. On the other hand, Becken and Simmons (2002) also investigate the consumption patterns of tourist attractions and activities in New Zealand. Their study explains the importance of leisure activities in energy use and concludes that visits to tourist attractions, such as museums, generally consume less energy than tourist motorized activities.

### 1.3. The relevant paper of cities on global tourism trends

Cities concentrate the majority of the world's economic activities; more than 50% of its residents are localized in urban areas thus cities have a vital role to play in the recognition of a Green Economy (Zorpas, Voukkali, & Navarro, 2017). Although a number of studies have been done on the carbon footprint (CF) of tourism in different regions, mostly in countries and islands (Björnsson, 2014; Grimm et al., 2008; Sisman & Associates, 2007), this study is a pioneer because it is one of the first to be carried out calculating the carbon footprint of tourism in a city.

Moreover, city trips are the fastest-growing market segment and have soared by 58% since 2013 to reach a 20% of the holiday market share, with a strong 15% rise in European cities (IPK International & ITB Academy, 2017). The rise of low cost airlines has also brought increased interest in cities and attracting a new type of product: city breaks (UNWTO, 2012). European Cities Marketing (ECM) announced a 3.6% growth in city tourism in 2016, with the domestic market increasing by 6.0% and the international market by 2.3%.

In general terms, high concentration of tourists causes considerable environmental deterioration, increased energy and water consumption, as well as waste generation. To supply the tourist areas it is necessary to create additional infrastructure and services in a limited area and with limited resources (Kreag, 2001, pp. 1–20). Most tourism-related activities require direct energy use in the form of fossil fuels (such as petroleum, coal or gas), or indirectly, in the form of electricity often generated from precisely these same fossil fuels.

To minimize the emissions effect, cities have a possible path of development in building a tourist offer based on sustainable, environmentally friendly and responsible tourism (Mačkiewicz & Konecka-Szydłowska, 2017). Urban green tourism (eco-tourism) is also a response to that need, as it was emphasized by the participants of the 3rd Global Summit on City Tourism (held in Barcelona in December 2014 and promoted by UNWTO), to make a city enjoyable to all, i.e. residents, tourists and investors, and to spread the benefits of urban tourism to its surroundings, thus reinforcing its impact and managing congestion.

### 1.4. The case study of Barcelona: a big touristic spot

Barcelona tourism is highly influenced by the increasing trend of urban tourism. During the period 2008–2015, Barcelona has experienced an increase of 25% in the number of tourists visiting the city (Barcelona City Council, 2015). The last few years have seen a proliferation of low cost airline companies in Barcelona airport: 70% of passengers that flew to Barcelona-El Prat Airport in 2016 did it with low-cost airlines (Aena, 2017). Barcelona is a clear example of the European trend toward short city touristic trips, where many tourists use low-cost airline companies and platforms to rent cheaper accommodation from particulars. The average length of a stay in Barcelona's tourism accommodation (i.e. hotels, apartments, etc.) is 2.9 overnights (Barcelona City Council, 2016a), and Barcelona City Council estimated that 45% of tourists chose Houses for Tourist Use (HTU) (Duatis, Buhigas, & Cruz, 2016). Moreover, Barcelona tourism, similar to other Mediterranean areas, is also influenced by seasonality due to the good climate conditions and the proximity to the coast (Barcelona City Council, 2015; Sanyé-Mengual et al., 2014).

With a population of more than 1.6 million inhabitants, (3.3 million if the whole Barcelona metropolitan area is considered) Barcelona is today one of the world's leading tourist destinations. Barcelona city is a major cultural and economic center in South-Western Europe and a growing business center (UNWTO, 2012). It is also a strategic transport hub. As one of the most important ports in Europe it received 749 annual cruises carrying 2.5 million passengers in 2014 (Port of Barcelona & Barcelona Tourism, 2015b). Barcelona's international airport handles around 40 million passengers per year and the city has an extensive motorway network (Barcelona Tourism et al., 2016). The city has also become the new high-speed rail link between Spain and France, currently the second longest continuous high-speed rail line in the world.

All this contributes to making the tourism sector one of the most important economic generators of the city. It represents around 13% of Barcelona GDP (Garriga & Rigall, 2015) and is also connected with other key sectors such as transport, hospitality, retail, etc. According to the Global destination Cities Index 2016 (Hedrick-Wong & Choog, 2016), Barcelona is ranked as the 12th most visited city in the world in 2016 and 4th on the European continent (with 8.2 million international tourists that stay overnight in hotels), only behind London (19.88M), Paris (18.03M) and Istanbul (11.95M).

Local authorities estimated that the total number of visitors – summing tourists that stay overnight and day-trippers – to Barcelona city throughout the year 2015 was approximately 33 million and that mainly concentrate in some very specific areas of the city (Barcelona Tourism et al., 2016). Due to this high volume of tourism, the City Council has device a Strategic Plan to address and manage the impact that tourism has on the city. In the latest version of Barcelona Strategic

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