CONSIDERING THE ATTICA EXAMPLE: HOTEL LOCATION AS A DETERMINANT FACTOR OF TOURIST CARBON FOOTPRINT

Stella Panayiota Pieri[1*], Panayiotis Kouyias[1], Vasiliki Milioni[1], Athanasios Stamos[1], Ioannis Tzouvadakis[1]

1 National Technical University of Athens
Iroon Polytexneiou 9
15780, Zografou
Athens
**Corresponding author: cpieris@tee.gr*

ABSTRACT

The tourism industry is responding to the widespread concern over the future of the global climate. However, little quantitative work has been done on carbon dioxide emissions associated with tourism destinations. This paper proposes a framework illustrating how this can be done. The tourist carbon footprint (TCF) is a result of tourists' personal consumption, transportation, activity, and accommodation costs. In this study we evaluate the tourist carbon footprint associated with tourist transportation to and in the vicinity of the prefecture of Attica, Greece. The research, conducted in three stages, aims to demonstrate how important is hotel location as a determinant factor of tourist carbon footprint and to propose measures to reduce CO2 emissions through the implementation of policies that are environmentally friendly and are aiming to facilitate the transport of the tourists and promote the use of public transport.

KEYWORDS

Tourist carbon footprint (TCF), Tourist transportation, CO2 emissions, hotel location

1 INTRODUCTION

Tourism is travel for recreational, leisure, or business purposes. The World Tourism Organization defines tourists as people "traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes" (World Tourism Organization, 1995). The tourist carbon footprint (TCF) is a result of tourists' personal consumption, transportation, activity, and accommodation costs. The study evaluates the TCF associated with tourist transportation. The first part of the paper portraits the research tool used to acquire the input data and the methodology used for analyzing and processing this data. The second part of the paper presents the mathematical formula and the calculations made for each of the 21 hotel units that took part in the survey. Calculations are made of the TFC produced by the transportation of tourists of each hotel. Consequently, the results are presented and evaluated in a series of tables and diagrams. Finally, the study puts forward proposals for a series of low-cost measures which could be adopted by the hotels management and tourist stock. The aim of the research is to determine the importance of hotels location in a reduced TFC. The hotels included in the study vary in size and category but are all city-hotels.

2 THE RESEARCH TOOL AND METHODOLOGY

Most research on Tourist carbon footprint draws almost exclusively on tourists retrospective self-reporting. According to Nielsen and Blichfeldt (Nielsen, Blichfeldt, 2009) although any vacation contains many in situ decision-making processes, most research on vacation decision-making emphasizes up-front decision-making (and especially the generic decision 'to go' and choice of destination) whereas research on in situ decision-making is very sparse (Nielsen, Blichfeldt, 2009). Apart from the obvious methodological problems with retrospective self-reporting, such reporting is especially problematic in relation to in situ decision-making due to the simple fact that tourists make so many decisions in situ (some of which are indeed minor) that it is highly doubtful if (1) tourists even remember them when they are later interviewed or fill out a questionnaire and/or (2) the interview/questionnaire situation actually allows tourists to go into details to the extent necessary in order to uncover in situ choices and movements. Accordingly, any 'new' methods that (could) provide knowledge on tourist mobility at the destination would undoubtedly be a valuable tool in the quest to fill the knowledge gap pertaining to touristic behaviour at the destination (Nielsen, Blichfeldt, 2009).

In this study, we decided to deliberately ignore the individual tourists in-situ decision making and focus on net road distances and numerical statistical data. The questionnaire was thus addressed to the management of the hotels instead of the tourists, in an effort to actually approximate the value of the tourist carbon footprint which could be attributed to each hotel. In order to draw valid conclusions a significant number of hotels from the existing hotel stock in Attica had to be studied. Additional data were collected from personal interviews with accommodation managers at each location and incorporated into the TCF calculation.

Consequently, the tourist attractions of the hosting prefecture Attica were highlighted and all tourist destinations were hierarchized and matched in weighting factors according to their rate of popularity which was decided after thorough bibliographical research.

Information about the road distance between each hotel and each of the previously mentioned tourist destination was calculated with a GPS system. The following map illustrates the location of the hotels that participated in the research whereas the adjacent table presents the places of tourist interest considered in the study.

Map 1. Geographical sites of tourist interest in Attica

3 DATA COLLECTION

Out of the 50 hotels originally approached only 21 responded positively and provided all necessary information. In the research sample the hotels vary both in size and category and range from a 2* thirty bed hotel to a 5* star 374 bed hotel. They all consist of city hotels and they are all located in the prefecture of Attica in Greece.

The data collected consisted of:

i. The annual number of clients staying in a hotel
ii. The percent of each customer type.
iii. The duration of the stay of the various types of tourists.
iv. The percent of tourists visiting each of the different sites of tourist interest previously specified.
v. The percent of tourists visiting each of the different sites with each of the different means of transportation.
vi. The Carbon emissions factor of the various modes of transportation.

As far as transport modes are concerned, it should be noted that air travel is clearly the most significant overall source of greenhouse gas emissions in land-based tourism out weighting any other emissions resulting from in-land mobility.

4 CALCULATION OF TOURIST CARBON FOOTPRINT ASSOCIATED WITH TRANSPORTATION

All data collected were processed individually for each hotel unit with the software Microsoft Excel and the following mathematical formula:

$$TCF_{transport} = 2 \times S_i \times \lambda \times X \times P_i \times k \quad (1)$$

Where:

$2 \times S_i$: two-way distance of hotel development from sites of tourist attraction

X: annual number of tourists staying in a hotel

λ: estimated percentage of tourists visiting each site of tourist attraction

P_i: estimated rate of use of each mode of transport

k: Carbon Emissions factor for each means of transport

Table 1. Carbon Emissions Factor per unit of measurement of each mode of transport.

Transportation	**Unit of measurement**	**Kg CO2 / unit of measurement**
Metro(fixed rail)	Passenger kilometre (pkm)	0,07801
Bus	Passenger kilometre (pkm)	0,10351
Taxi	Distance vehicle (vkm)	0,22169
Car	Distance vehicle (vkm)	0,15

5 THE RESULTS

Table **2** illustrates the results that came out from the analysis of each one of the hotels under study, as far as, their tourist carbon footprint is concerned. It is obvious that tourists staying in hotels located in the wider area of Athens city centre have a lower carbon footprint as a result of: 1) their proximity to the most popular sites of tourist attraction, some of which are even within walking distance and 2) the better network of Public Transport. The crucial role, that hotel proximity to the city center plays in the formulation of the tourist carbon footprint of each hotel is easily perceived by a close observation of Map no.1 illustrating the dispersion of sites of tourist attraction on the map of Attica.

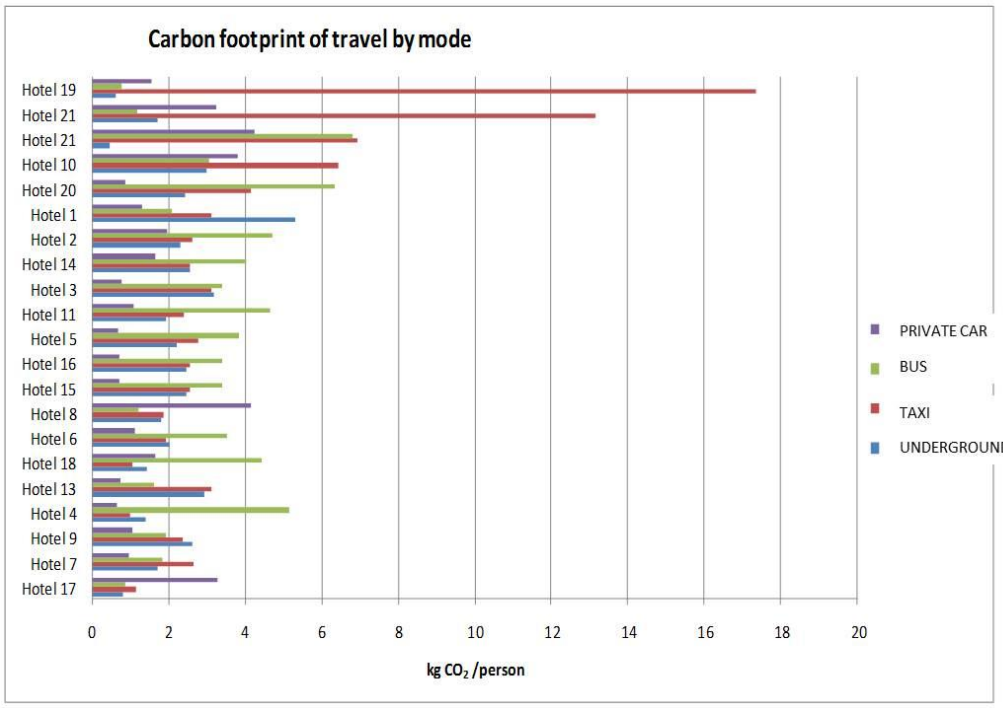


Figure 1. Calculation of TFC by mode of travel for each hotel

Table 2. Annual Carbon Emissions per hotel and per customer

A/A	Location	Annual emmissions kgCO2/Hotel	Annual emmissions kgCO2/Person
1	Southwest Attica (Pireus)	51543.46	11.86
2	Southwest Attica (N. Smirni)	622804.68	11.63
3	Downtown Athens (close to Larisis st.)	504639.24	10.05
4	Downtown Athens	152811.18	8.23
5	Downtown Athens	419219.83	9.55
6	Downtown Athens	380511.64	8.67
7	Downtown Athens	203917.29	7.17
8	Southwest Attica (Moshato)	36143.97	9.01
9	Downtown Athens	147670.18	8.02
10	Southwest Attica (Glyfada)	271067.5	16.31
11	Southwest Attica (Ampelokipi)	786353.02	10.08
12	North section of Athens (Kifisia)	128190.77	19.31
13	Downtown Athens	227618.83	8.43
14	Downtown Athens (Siggrou Av.)	324083.83	10.82
15	Downtown Athens (Ilissia)	140242.45	9.17
16	Downtown Athens (Ilissia)	41652.01	9.17
17	Downtown Athens	54709.93	6.13
18	Downtown Athens	28756.86	8.6
19	Eastern Attica	144623.36	20.29
20	Southwest Attica (Paiania)	239611.92	13.83
21	Southwest Attica (Vouliagmeni)	403515.27	18.48

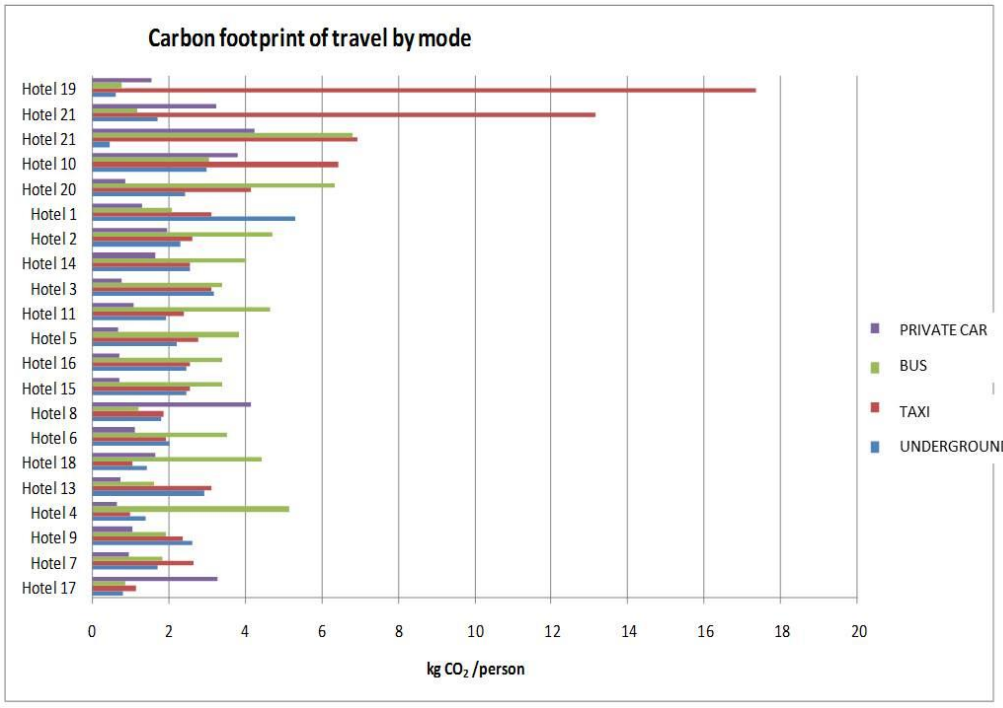


Figure **1** presents the TCF by mode of transport for each one of the hotels under study. The hotels on the vertical axis are classified in ascending value depending on their annual carbon TFC. The fact that the distance between a hotel and the center of Athens influences the transportation TCF, can be better understood by comparing the results of all hotels under study in relation to their distance from the center. For this purpose, we selected a fixed point and measured the distance of each hotel from it. The point chosen as benchmark was Omonia Square. Generally, it is observed that the carbon footprint tends to increase as the distance from Omonia Square increases. Nevertheless, the relationship between distance and the TFC is not strictly proportional. This is due to the fact that TFC is also influenced by a series of other the factors incorporated in the formula.

Table 3. Distance of hotels from Omonia Square (km)

A/A	Distance from Omonia Sq. (km)
D1	9
D2	6,4
D3	1,2
D4	0,8
D5	1,2
D6	1,4
D7	2,4
D8	6,7
D9	1,1
D10	14,9
D11	3,6
D12	15
D13	1,2
D14	3,7
D15	2,9
D16	2,8
D17	0,3
D18	1
D19	18,5
D20	12,3
D21	18,4

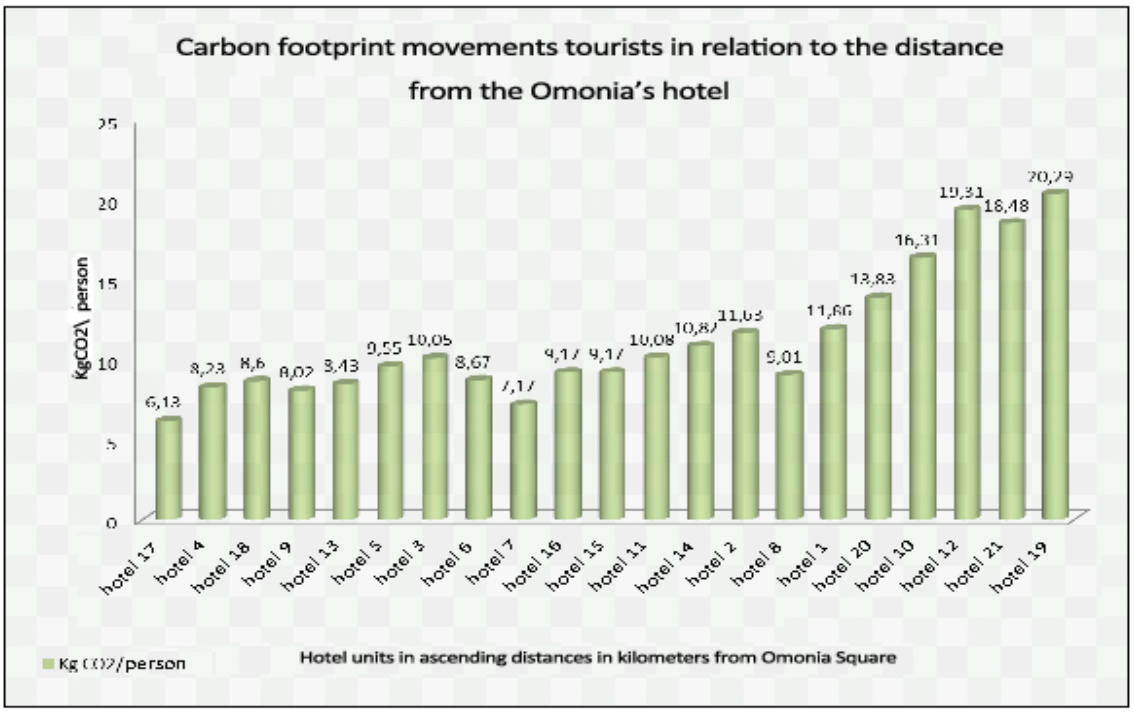


Figure 2. TCF analysis in relation to the distance from the city center.

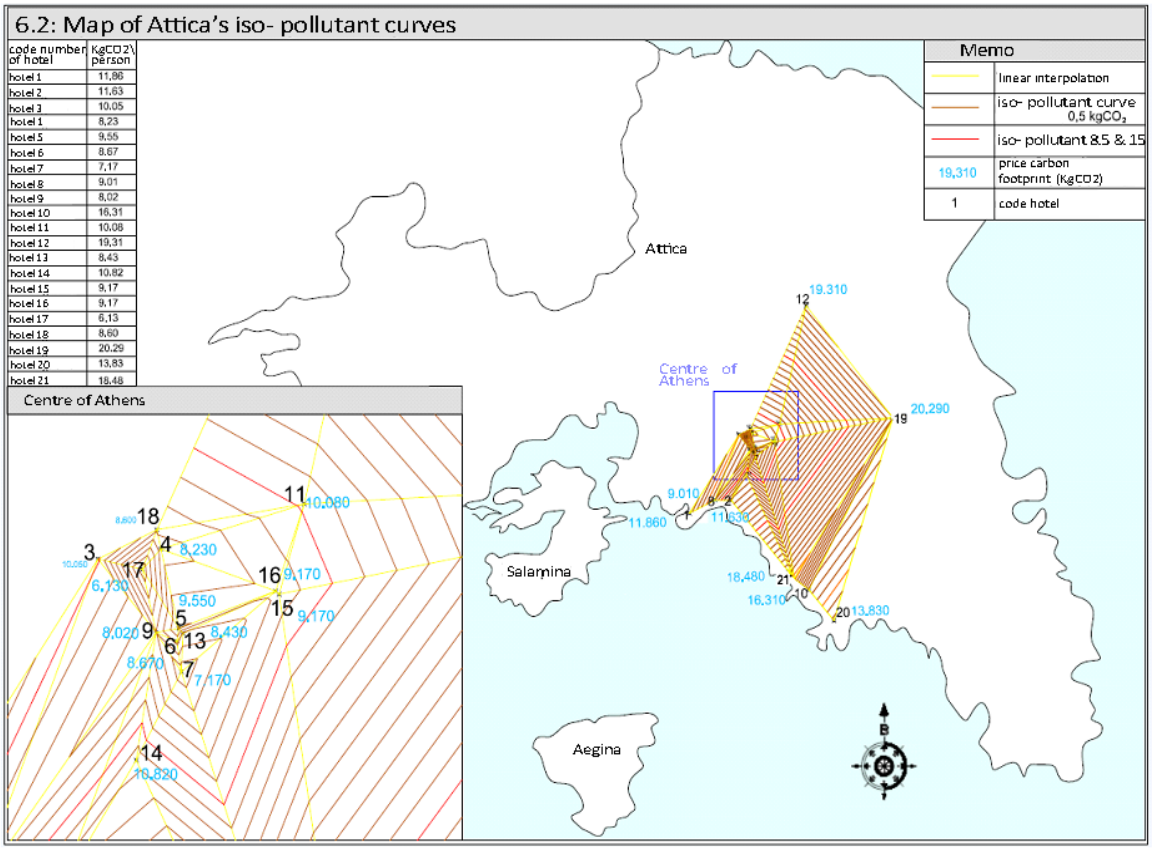
6 MAPPING THE RESULTS

To visualize the influence of hotel location in determining the tourist carbon footprint that results from tourist trips, we invented the iso-pollutant curves map. The iso-pollutant curves map is a detailed and accurate graphic representation of the typical value of carbon footprint at a particular geographical area or point. In particular, the map below illustrates the areas of

Attica, that tend to have more or less the same carbon footprint per hotel guest. Specifically, it appears that the areas near the center of the capital have less carbon footprint than the regional areas, mainly because of there is a concentration of the most important sites of tourist attraction such as museums , the Acropolis , Plaka , Monastiraki, shopping centers etc.

These areas are clearly separated in zones by their respective iso-pollutant curves shown on the map with red lines:

1. Zone A : City Center, with Tourist Carbon footprint (TCF) : TCF < 8.5 kgCO2/ tourist
2. Zone B: peripheral kgCO2/ tourist with 8.5 < = TFC < 15.0 kgCO2/ tourist (ie Piraeus)
3. Zone C: Suburbs with TCF > = 15 kgCO2/ tourist



Map 2. Atttica - TCF iso-pollutant curves map

7 CONCLUSION AND PROPOSALS

By collecting hotel reservations statistics concerning the hotel occupancy, the hotel category, the per cent of each customer type hosted yearly, the length of stay, the country of origin, the mode of transport to the area of their destination and identifying the most popular tourist sites, we managed to have a value of the TCF which could be attributed to the hotel and which is a function of the hotel location as illustrated by the mathematical formula and the iso-pollutant curves map.

To sum up, in Attica the tourist carbon footprint varies between 28.756 Kg CO2 to 786.353 Kg CO2 per hotel and between 6,13 KgCO2 to 20,29 Kg CO2 per tourist yearly. Hotel no. 17, which is located at Omonia Square has the lowest carbon footprint., whereas Hotel no. 19

located at Attiki Odos, Paiania has the highest value.Furthermore, the further away a hotel is from the city center the higher the tourist carbon footprint.

It is therefore evident, that the TCF could be minimized through the choice of the appropriate location for a new hotel development at the earlier stages of strategic planning. Low TCF is associated with proximity to sites of tourist interest, which is also a requirement for the convenience of most tourists. The hotel management could reduce the TFC of the hotel through a series of measures that encourage customers to use public transport, bicycles or move on foot for their transportation during their stay. Low TCF could also be achieved in various ways through the information and awareness of the customers of their impact on the environment and of their carbon footprint, but also through the organization and planning of group excursions to sites of tourist attraction. Finally, the hotels through the purchase and use of hybrid cars and mini-vans for the transportation of their customers to the city center or other places of tourist interest, could reduce further their TFC.

In the same time, the government and in particular the ministry of transport by strengthening the existing grid of Public Transport (grid frequency) and replacing conventional fuels with biofuels could enhance the hotel sectors effort towards a lower TFC.

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