Carbon footprint of Educational Establishments: The Case of the University of Alicante

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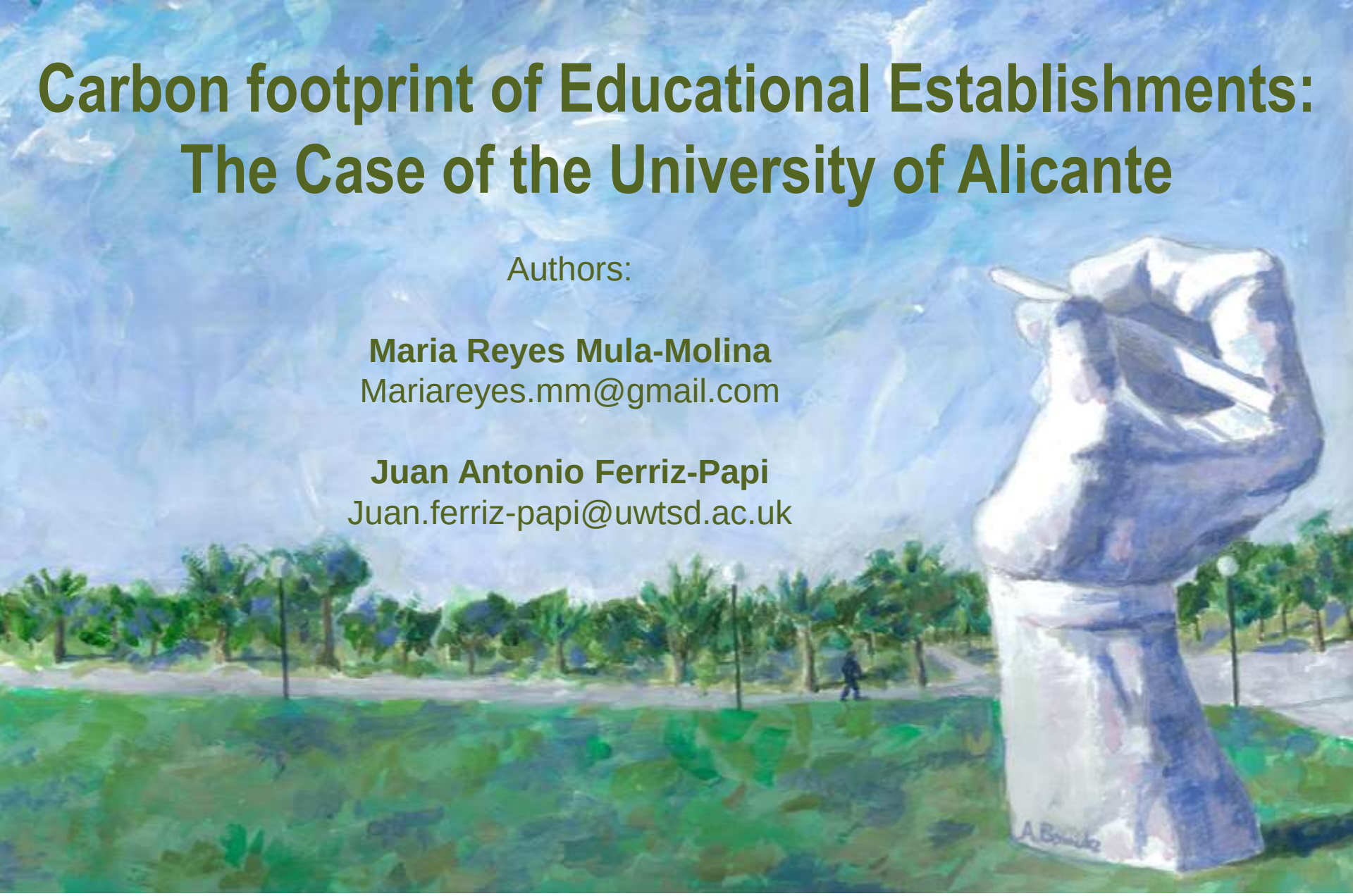

Universitat d'Alacant
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ICABE 2016 London

WASET

1. Introduction

2. Aim and Objectives

3. Methodology

4. Results and analysis

5. Conclussions

Society expectative about environment protection and sustainable development

Universities as centres of knowledge and research excellence

Solutions for our challenging world

Environment awareness of Spanish Universities

- CRUE. Environment Quality and Sustainable Development Workgroup
- 2007. Creation of ECOCAMPUS office at the University of Alicante

Necessity of environment assessment

- Know present situation – scarce or non-existing information
- Some actions already carried out. Others to put in practice

Aim:

- Develop a simplified methodology to calculate and compare carbon emissions per user at the University campus.

Objectives:

- Study other methodologies applied in different campuses in Spain;
- Establish own methodology considering building operations and transport;
- Compare and analyse these results.

- Sustainable development
- Environment assessment
- Indicators

- Ecological footprint
- Carbon footprint
- Corporate ecological footprint

INFORMATION COMPILATION + REFERENCES

METHODOLOGIES FOR ASSESSMENT

DEFINITION OF OWN METHODOLOGY

- UN publications
- ISO,BSI, AENOR
- EU Directives
- World Resources Institute
- etc.

- University of Santiago de Compostela
- University of Barcelona
- Polytechnic University of Cataluña
- Miguel Hernández University

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N-338
aeroport
CV-849
l'Altet
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Balsares
N-340
R. Seco
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CV-771
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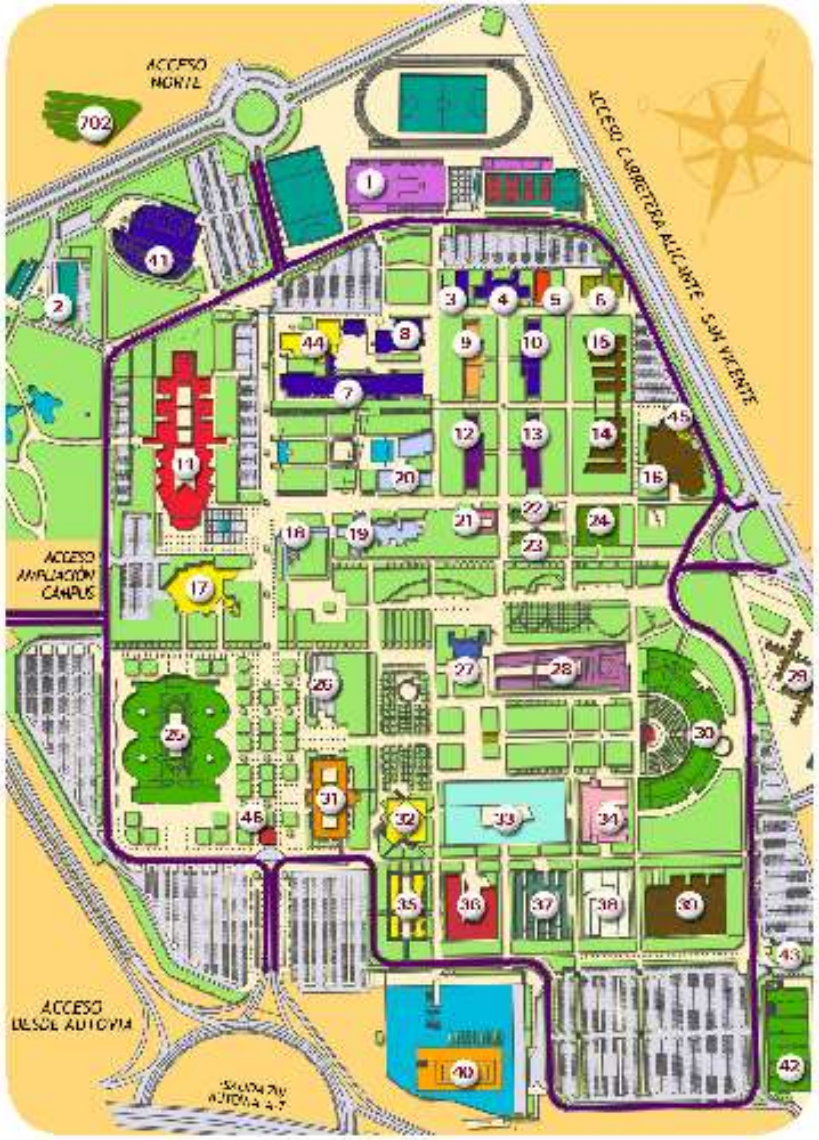
Alicante Alacant
Aigua Amarga
els Saladars
els Arenals del Sol



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ESTIMATION OF CARBON FOOTPRINT DUE TO BUILDING AND URBAN SERVICES IN THE CAMPUS

OBTAIN ENERGY CONSUMPTION

ESTIMATION OF ELECTRICITY CARBON EMISSIONS

- EMISSION FACTOR: ELECTRIC MIX

ESTIMATION OF NATURAL GAS CARBON EMISSIONS

- EMISSION FACTOR: IDAE

ESTIMATION OF TOTAL CARBON FOOTPRINT

ELECTRICITY
+
NATURAL GAS

RATE

- PER M^2 BUILT
- OVER THE CAMPUS
- PER USER

ESTIMATION OF CARBON FOOTPRINT DUE TO TRANSPORT

DIFFERENT SITUATIONS

- TRANSPORT SURVEY
- UNIVERSITY USERS
- SPANISH FLEET
- ACADEMIC CALENDAR
- ESTABLISH % OF DAILY ATTENDANCE
  - TERM TIME
  - OUTSIDE TERM TIME
- ASIGN AVERAGE CONSUMPTION
  - FUEL TYPE
  - VEHICLE TYPE

ESTIMATION OF USERS PER TYPE OF VEHICLE

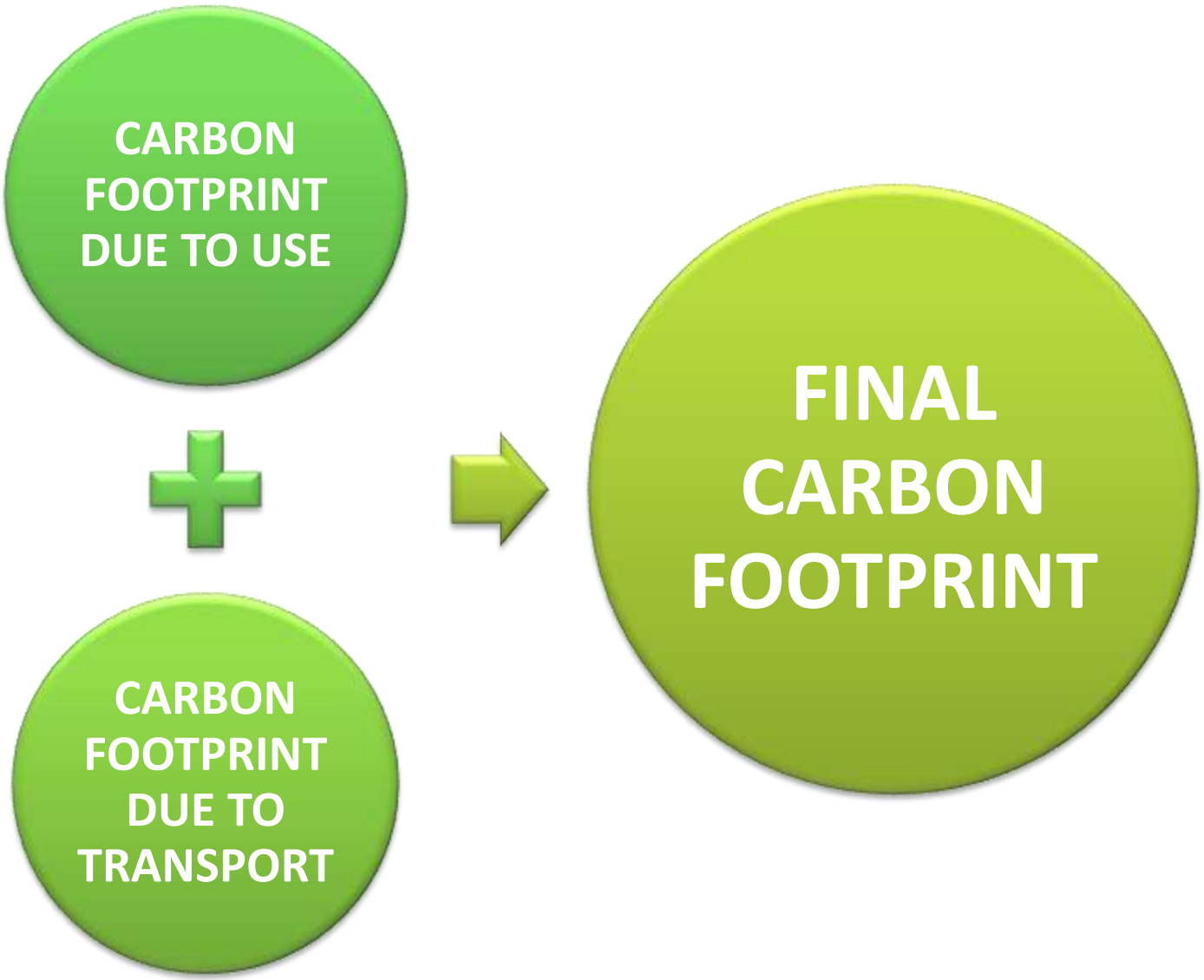
NUMBER OF TRIPS

ASSIGN AVERAGE DISTANCE

ESTIMATION OF DAILY km

- (L) OF DAILY FUEL
- CONVERSION FACTORS: IDAE

RATE PER USER

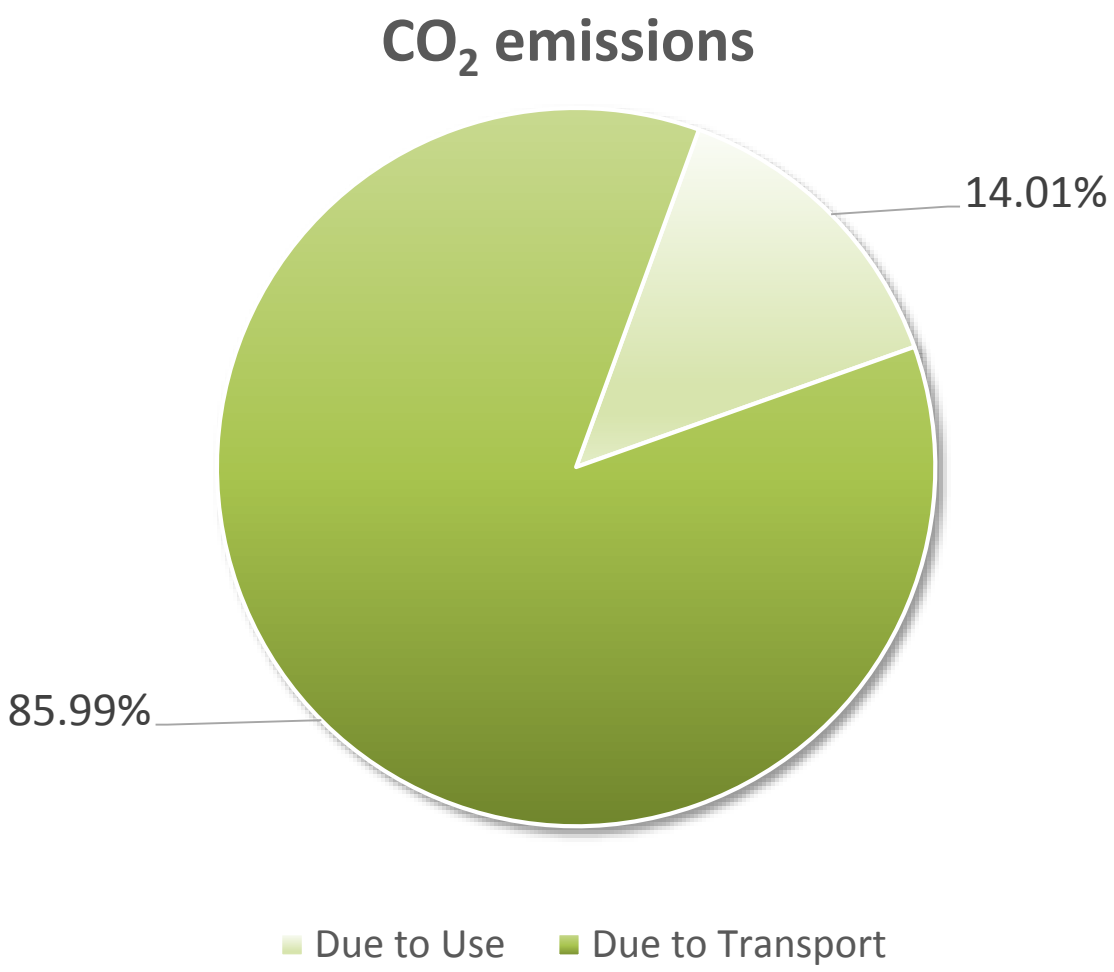

CARBON FOOTPRINT DUE TO USE
CARBON FOOTPRINT DUE TO TRANSPORT
FINAL CARBON FOOTPRINT

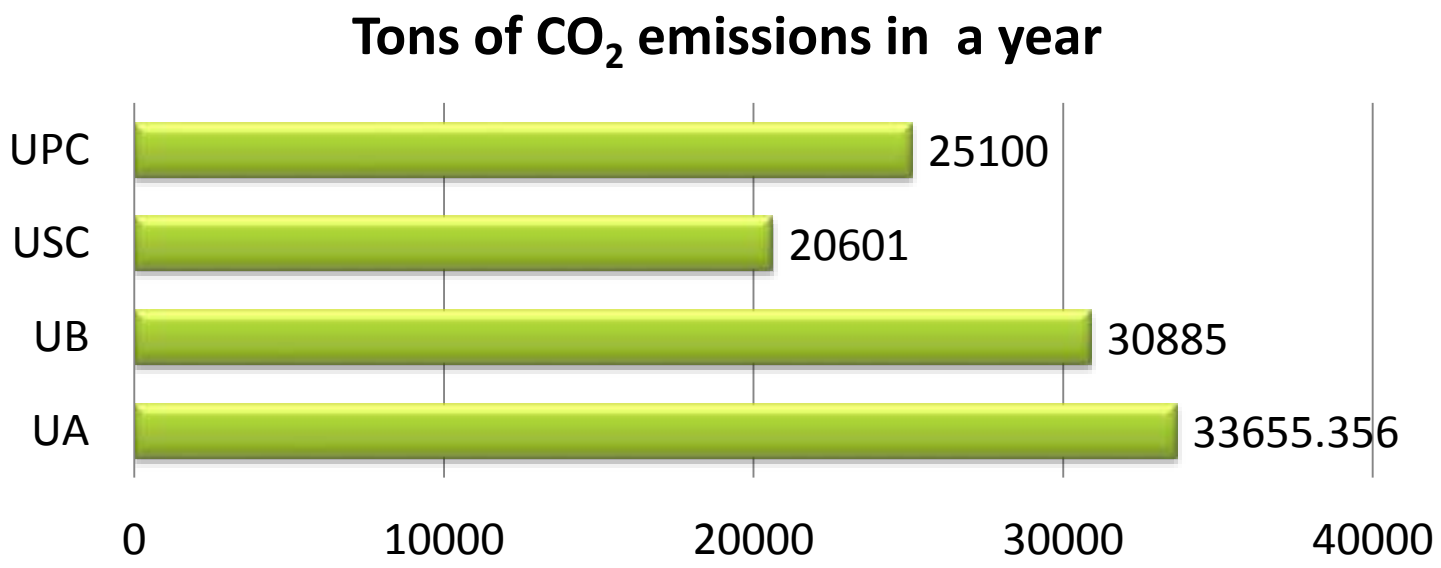
2011		
Kg CO_2		TOTAL
Carbon Footprint due to Use	Carbon Footprint due to Transport	
4,716,481	**28,938,875**	**33,655,356**

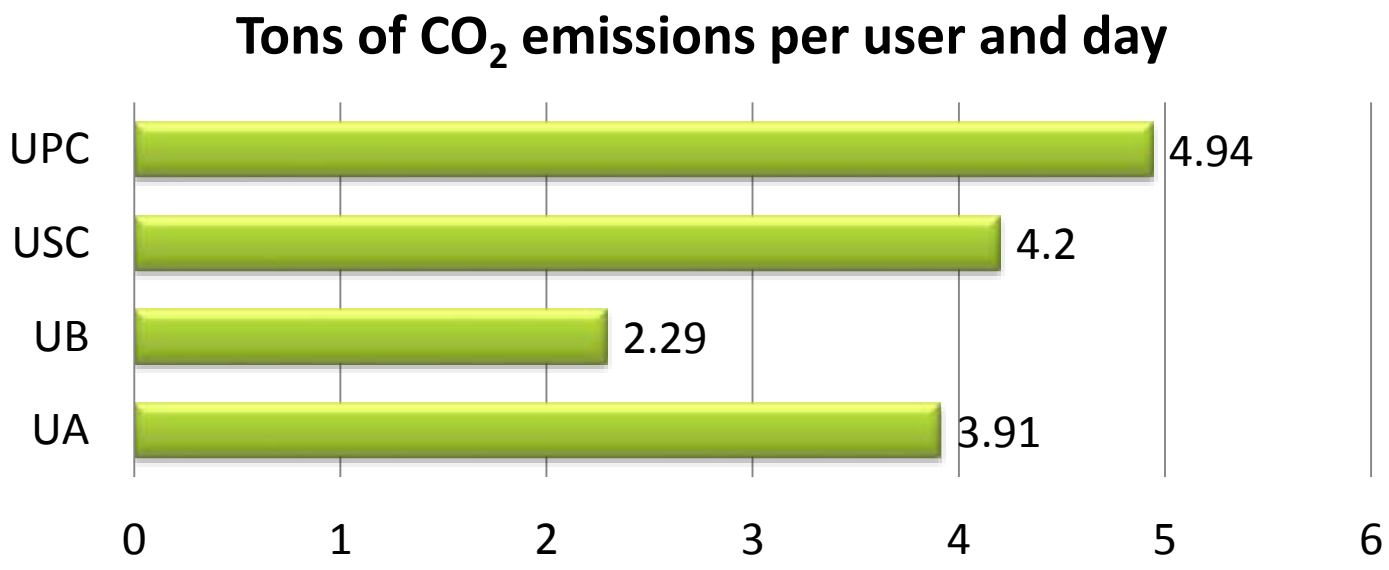
RATE PER USER

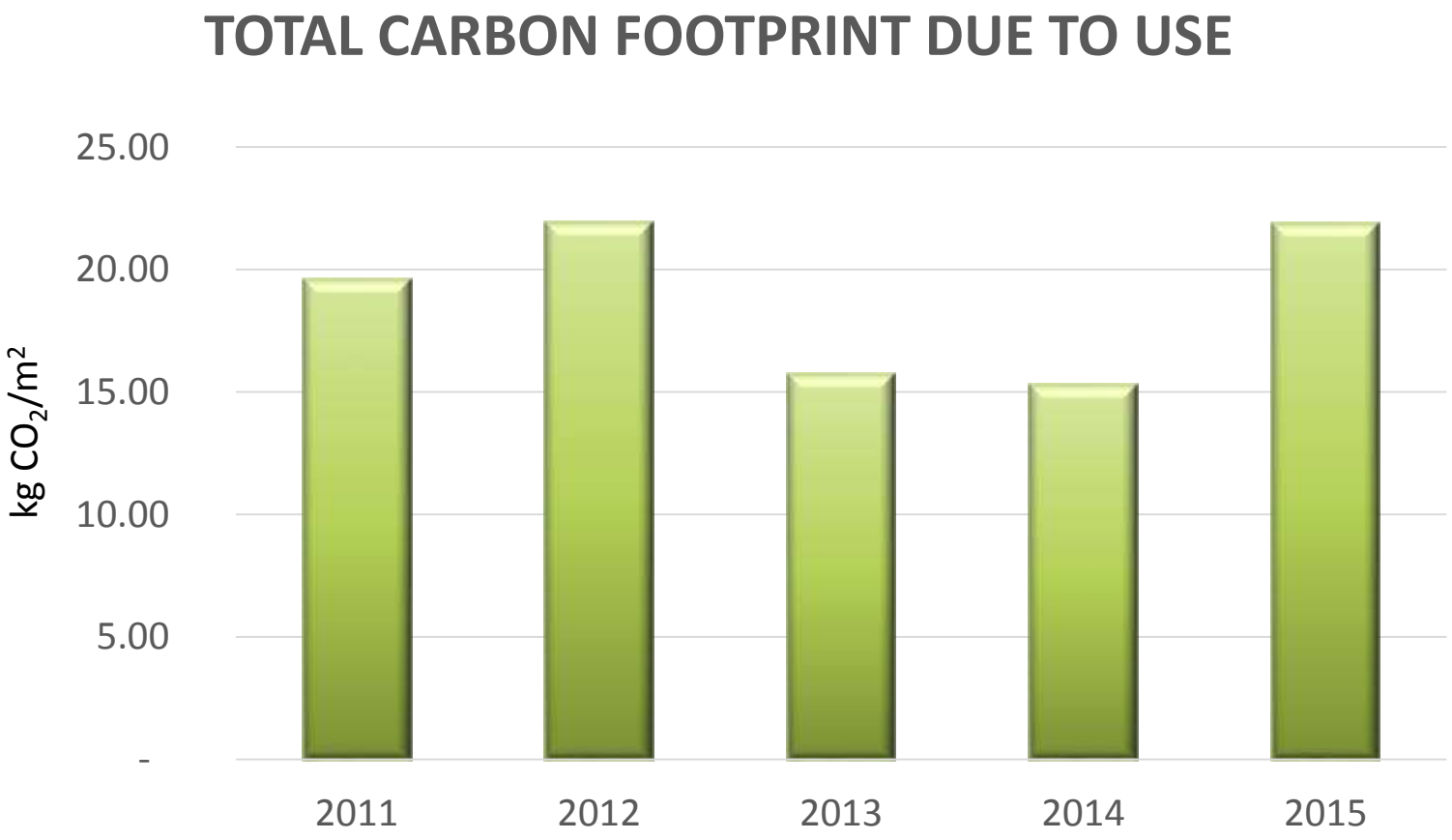
$$Emissions\ per\ user = \frac{33{,}655{,}356}{43{,}258} = \mathbf{778.01\ kg\ CO_2\ per\ year}$$

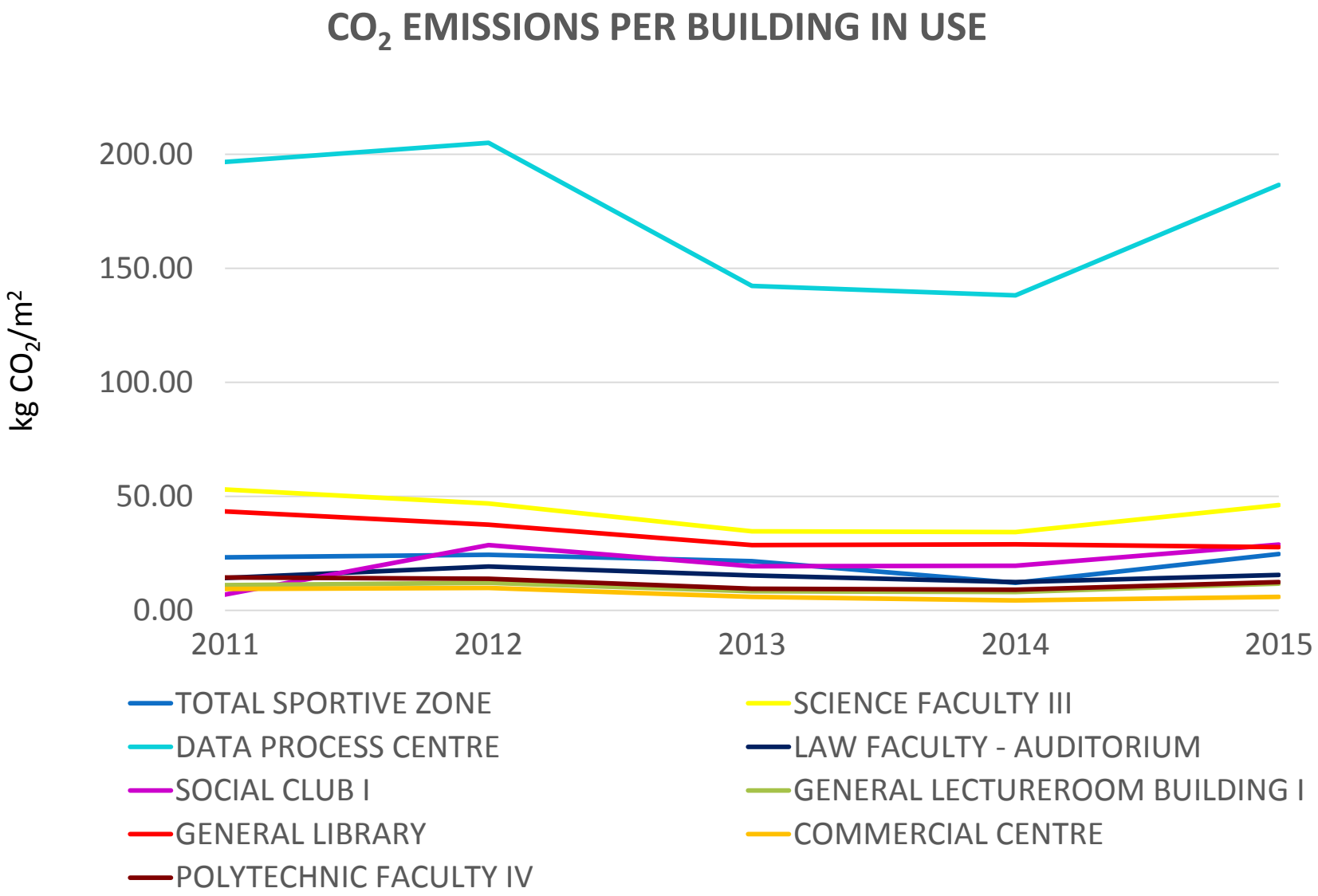
$$Emissions\ per\ user = \frac{778.01}{199} = \mathbf{3.91\ kg\ CO_2\ per\ day}$$


CO_2 emissions
14.01%
85.99%
Due to Use
Due to Transport


Tons of CO_2 emissions in a year
UPC
USC
UB
UA
25100
20601
30885
33655.356
0
10000
20000
30000
40000


Tons of CO_2 emissions per user and day
UPC
USC
UB
UA
4.94
4.2
2.29
3.91
0
1
2
3
4
5
6


TOTAL CARBON FOOTPRINT DUE TO USE
kg CO_2/m^2
25.00
20.00
15.00
10.00
5.00
-
2011
2012
2013
2014
2015


CO2 EMISSIONS PER BUILDING IN USE
kg CO2/m2
200.00
150.00
100.00
50.00
0.00
2011
2012
2013
2014
2015
TOTAL SPORTIVE ZONE
DATA PROCESS CENTRE
SOCIAL CLUB I
GENERAL LIBRARY
POLYTECHNIC FACULTY IV
SCIENCE FACULTY III
LAW FACULTY - AUDITORIUM
GENERAL LECTUREROOM BUILDING I
COMMERCIAL CENTRE

CONCLUSSIONS

- Methodology established for carbon footprint estimation
  - Consideration of use and transport footprints
  - Aspects not considered: water consumption, paper or other consumables, waste management, etc.

- No apparent decrease of carbon footprint
  - Energy meters since 2010
  - It was reduced in 2013 and 2014. What happened?
  - No evolution comparison per user, only per m2
  - New buildings have been incorporated, not analysed

- No possibility to split per use inside the building
  - Global meters, not per zones or use

- Different uses in each building, difficult to compare

- Transport Report only in 2011
  - No later information. Change in bus lanes and new tram lane

FURTHER RESEARCH

- Evolution of carbon footprint along time
  - Per user and per m2
  - Consideration of new buildings
  - Extension to other campuses of the UA
- Consideration of other carbon footprints
  - Water consumption
  - Paper and other consumables
  - LCA of buildings
- Action Plan to reduce the carbon footprint in this campus
  - Reduction of energy consumption
  - Separate energy meters per use
  - Use of renewable energies
  - New Transport Study
  - Analysis of uses in each building
  - Energy efficiengy, LED technology, Smart buildings
- Comparison to other universities. Network

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Thank you for your attention

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