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Universidad del País Vasco

Euskal Herriko Unibertsitatea

CBL
CAMPUS BIZIA LAB.

EHU-Aztarna
Ecological and social footprint of the University of the Basque Country: How to reduce our impact?

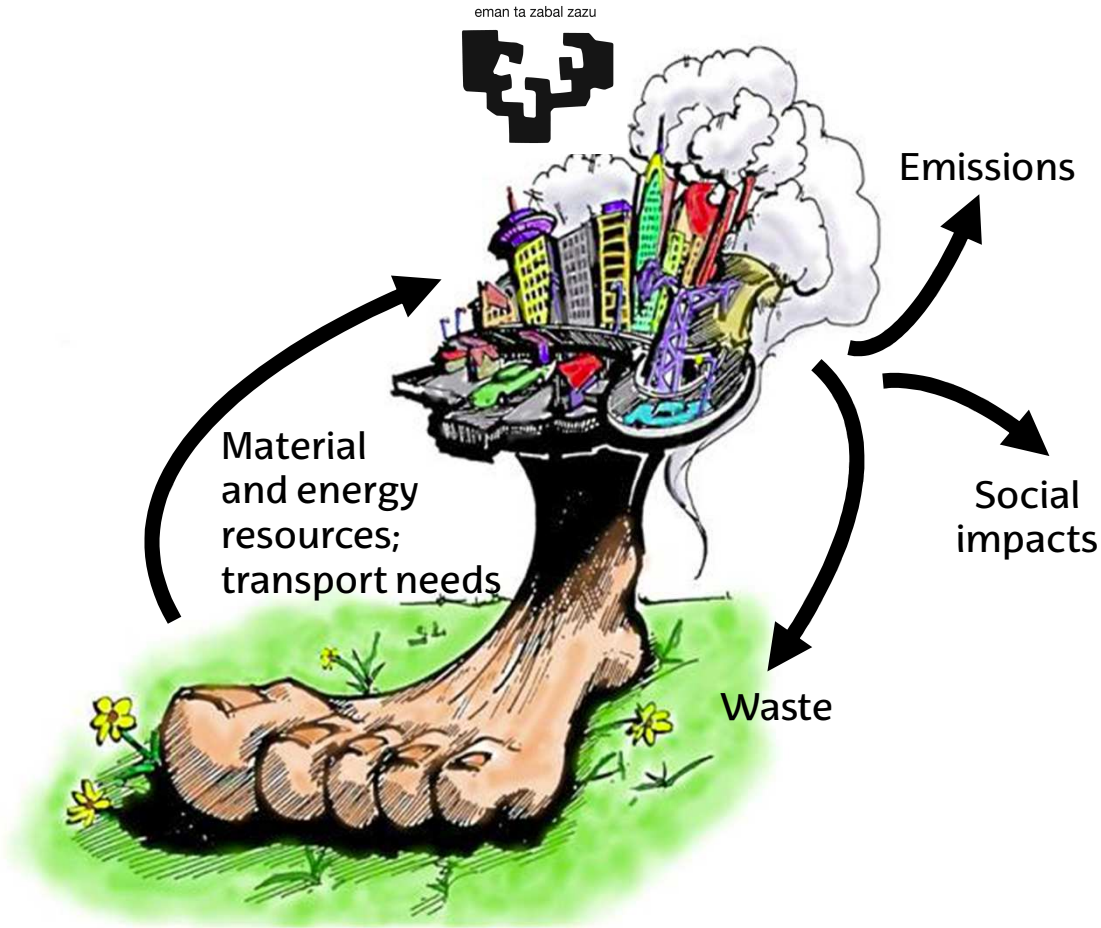
October 9th 2019 - Bilbao

INDEX

INTRODUCTION

EHU-Aztarna – our project

- ✓ **Objective:** to calculate the Organizational Environmental Footprint (OEF) of the academic activity of the University of the Basque Country (UPV/EHU) using the life-cycle thinking approach (LCA) and based on the methodology proposed by the European Commission. Our analysis will also include a Social Life-Cycle Assessment (S-LCA) based on the OEF of the UPV/EHU.



INTRODUCTION

EHU-Aztarna – our team

Multidisciplinary team: › 20 participants of 4 Faculties and central sevices of the University of the Basque Country (UPV/EHU):

- Faculty of Engineering (Bilbao)
- Faculty of Engineering (Donostia)
- Faculty of Economics and Business (Sarriko, Gasteiz)
- School of Architecture (Donostia)

The team consists of:

- Professors and research staff (PDI)
- Administration and services staff (PAS)
- Students from our Degrees and Masters in our faculties.

INTRODUCTION

EHU-Aztarna – our University

Users in the UPV/EHU:

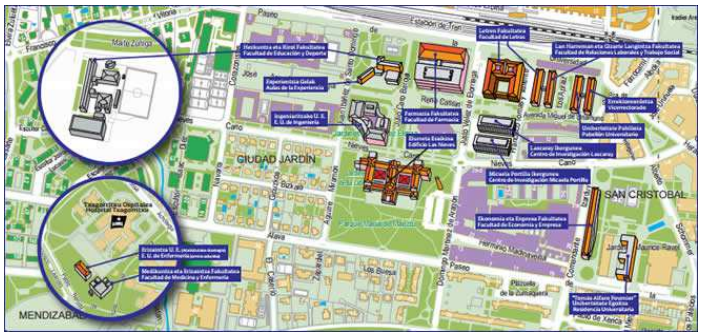
39 360 students
5 596 PDI
1 857 PAS

46 813 people in 2017

Our analysis takes into account Faculties and service buildings used by more than 95% of total users of the UPV/EHU in 2016.

Excluded faculties and buildings:

- Nautical School -Portugalete
- Faculty of Economics-Elcano
- School of Engineering-Eibar
- Student residences, Bizkaia Aretoa, Univ. Institutes...



METHODOLOGY

4.5.2013 ES Diario Oficial de la Unión Europea L 124/1

II

(Actos no legislativos)

RECOMENDACIONES

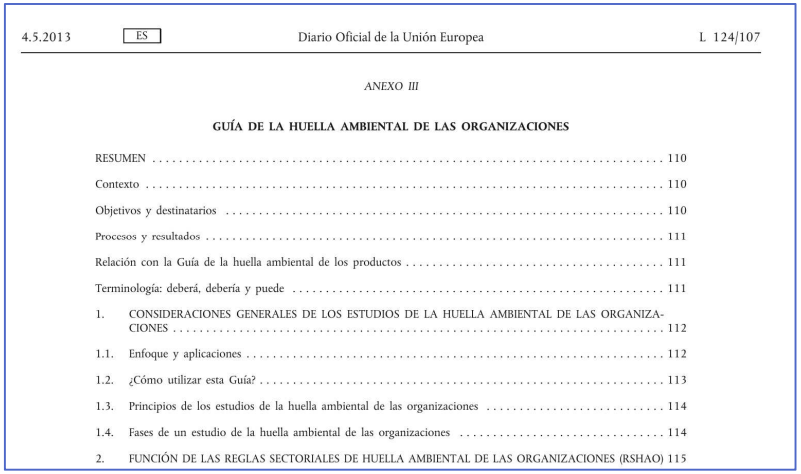
RECOMENDACIÓN DE LA COMISIÓN

de 9 de abril de 2013

sobre el uso de métodos comunes para medir y comunicar el comportamiento ambiental de los productos y las organizaciones a lo largo de su ciclo de vida

(Texto pertinente a efectos del EEE)

(2013/179/UE)



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ANEXO III

GUÍA DE LA HUELLA AMBIENTAL DE LAS ORGANIZACIONES

Our work is based on recommendations and documentation provided by the European Commission and IHOBE.

METHODOLOGY

MODELLING: openLCA and soca

1.- Inventory:

- ✓ Consumptions and waste ⇐ Data
- ✓ Transport needs ⇐ Modelling

ecoinvent Centre ⇩ openLca

2.- Environmental impacts ⇐ openLca

- ✓ CML (Baseline): midpoint methodology (classification and characterization) → **11** categories (i.e. global warming)
- ✓ ReCiPe: endpoint methodology (normalization and weighting, Hierarchical perspective) → **3** categories (i.e. human health)

3.- Social impacts ⇐ soca

- ✓ *Social Impact Weighting Method (Social and Environmental LCA, Life Cycle Costing), 1500 h/year* → **37** categories (i.e. fatal accidents)

⇩

Social impacts

METHODOLOGY

The Inventory (for year 2016)

CONSUMPTIONS | **WASTE** | **TRANSPORT**

Quantify/estimate

Electricity

Paper

Natural gas

Water

WEEE

Non-hazardous waste

Hazardous waste

- Municipal waste: paper, containers, glass, organic, residual,...
- Waste water
- WEEE

- Laboratory reagents
- Toners, batteries, fluorescents,...

Mobility survey

PDI
PAS
students

Mobility habits

Means of transport

Commuting habits

METHODOLOGY

Concept	Unit	Leioa	Donostia	Gasteiz	EIB-Bilbao	Sarriko
Electricity	MWh	16157	7400	10220	4204	1019
Natural gas	MWh	13644	8834	15037	1985	2194
Gas-oil	L	0	90	0	113694	0
Water	m^3	116963	27979	19045	23718	9925
Paper	kg	55022	18939	13183	29702	8738
Computers	Units	1131	976	545	630	234
Batteries	kg	421,5	81	185	65,8	80
Fluorescent lamps	Units	10623	500	200	2400	260
Toners	Units	1083	661	803	277	214
Hazardous waste	kg	23076	25576	9718	3756	0
Containers waste	kg	21622	5060	2996	3856	3634
Paper waste	kg	134200	48182	16754	9855	13909
Glass waste	kg	2171	621	1647	300	300
Organic waste	kg	0	20330	1488	0	0
Residual waste	kg	222000	19534	80126	60613	50504
WEEE	kg	10704	2352	2080	3500	1907
Sanitary wastewater	m^3	116963	27979	19045	23718	9925
Transport needs	$\times 10^6$ p·km	141,2	101,0	84,9	41,0	23,9

Inventory data for year 2016

METHODOLOGY

Concept	Leioa	Donostia	Gasteiz	EIB-Bilbao	Sarriko
Electricity					
Natural gas					
Gas-oil					
Water					
Paper					
Computers (desktops&laptops)					
Batteries					
Fluorescent lamps					
Toner consumption					
Toners waste					
Hazardous waste					
Containers waste					
Paper waste					
Glass waste					
Organic waste					
Residual waste					
WEEE					
Fluorescent waste					
Sanitary wastewater					
Transport needs					

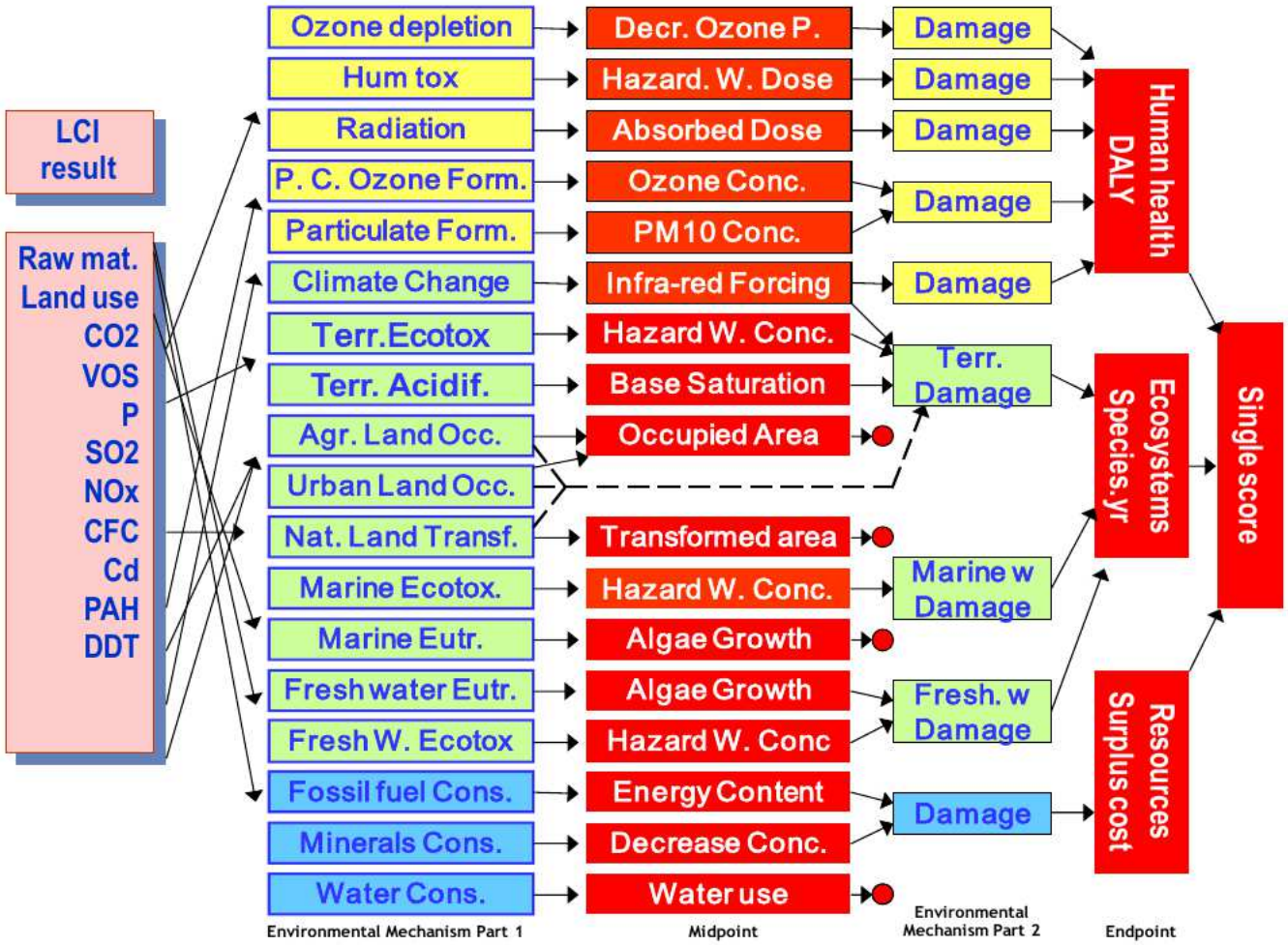
MEASUREMENT | SERVICE PROVIDER/BILLS | SURVEY/INTERVIEWS | PROJECTION | EDUCATED GUESS

METHODOLOGY

ENVIRONMENTAL IMPACTS

Method	Impact Category	Unit
CML	Terrestrial ecotoxicity	kg 1,4-dichlorobenzene eq.
	Ozone layer depletion	kg CFC-11 eq.
	Climate change*	kg CO_2 eq.
	Photochemical oxidation - high NO_x*	kg ethylene eq.
	Acidification potential	kg SO_2 eq.
	Eutrophication	kg PO_4^{3-} eq.
	Marine aquatic	kg 1,4-dichlorobenzene eq.
	Depletion of abiotic resources - fossil fuels	MJ
	Human toxicity*	kg 1,4-dichlorobenzene eq.
	Depletion of abiotic resources - elements, ultimate reserves*	kg antimony eq.
	Freshwater aquatic ecotoxicity	kg 1,4-dichlorobenzene eq.
ReCiPe	Human Health*	DALY (Disability Adjusted Life Year)
	Resources*	$
	Ecosystems*	species·yr

METHODOLOGY



Midpoint and Endpoint environmental impact indicators. Source: ReCiPe 2008.

METHODOLOGY

SOCIAL IMPACTS

Stake-holders	Category	Stake-holders	Category
Local Community	Biomass consumption	Workers	Association and bargaining rights
	Certified environmental management system		Child Labour, female
	Drinking water coverage		Child Labour, male
	Fossil fuel consumption		Child Labour, total
	Indigenous rights		DALYs due to indoor and outdoor air and water pollution
	Industrial water depletion		Fair Salary
	International migrant stock		Fatal accidents
	International migrant workers (in the sector/ site)		Frequency of forced labour
	Minerals consumption		Gender wage gap
	Net migration		Goods produced by forced labour
	Pollution		Non-fatal accidents
	Sanitation coverage		Safety measures
	Unemployment		Social security expenditures
Society	Education		Trade unionism
	Health expenditure		Trafficking in persons
	Illiteracy		Violations of employment laws and regulations
	Youth illiteracy		Weekly hours of work per employee
Value Chain Actors	Anti-competitive behaviour or violation of anti-trust and monopoly legislation		Workers affected by natural disasters
	Corruption		Economic Costs

METHODOLOGY

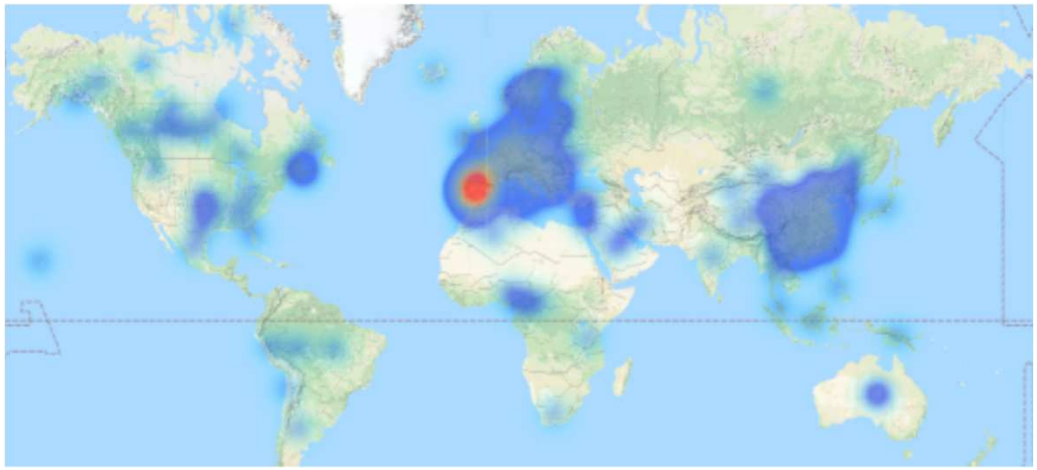
DATA ANALYSIS. Contribution to impact categories by:

Subprocesses

- ✓ Academic activity
- ✓ Transport
- ✓ Energy
- ✓ Materials
- ✓ Waste

Location

- ✓ Basque Country
- ✓ Outside of Basque Country
- ✓ Not defined



Scenarios

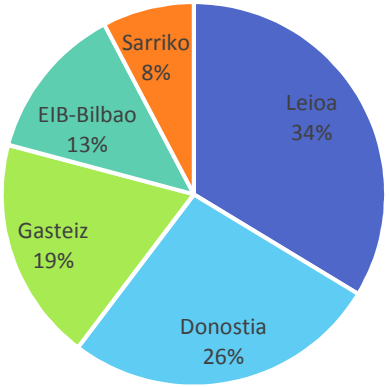
- ✓ Reference scenario
- ✓ Extending computer equipment lifetime 2 years
- ✓ Changing to a more sustainable mobility (1/2 private car users -› bus)
- ✓ Consuming all electricity from renewable sources

RESULTS AND DISCUSSION

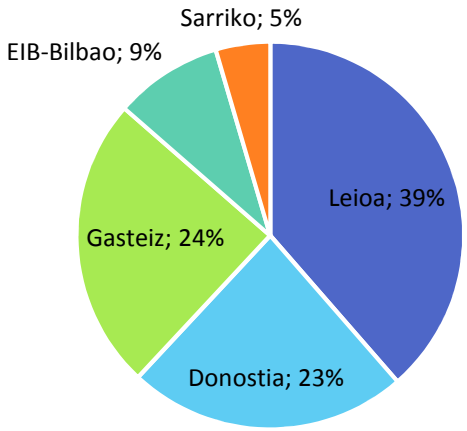
ENVIRONMENTAL IMPACTS – UPV/EHU

	Users	Terrestrial ecotoxicity kg 1,4-dichloro-benzene eq.	Ozone layer depletion kg CFC-11 eq.	Climate change GWP100 kt CO_2 eq.	Photochem. Oxidation high Nox kg ethylene eq.	Acidification potential kg SO_2 eq.	Eutro-phication kg PO_{4---} eq.	Marine aquatic ecotoxicity Mt 1,4-dichloro-benzene eq.	Depletion of abiotic resources - fossil fuels TJ	Human toxicity t 1,4-dichloro-benzene eq.	Depletion of abiotic resources - elements kg antimony eq.	Freshwater aquatic ecotoxicity t 1,4-dichloro-benzene eq.	Human Health DALY	Resources M$	Ecosystems species·yr
Leioa	15024	98470	3,56	22,6	4757	105869	29326	72,1	303	13303	150	15771	47,2	1,28	0,228
Donostia	11879	64077	2,19	13,7	3032	61954	17756	12,4	187	8122	121	4494	29,0	0,80	0,138
Gasteiz	8396	54709	2,25	14,3	2771	61318	15996	11,4	197	6538	77	3811	29,0	0,82	0,141
EIB-Bilbao	5865	25775	0,84	5,3	1195	25809	7868	14,9	70	3506	60	3323	11,6	0,30	0,059
Sarriko	3441	12469	0,42	2,7	556	11147	3451	9,7	36	1761	25	2120	5,6	0,16	0,028
UPV/EHU	**44605**	**255499**	**9,25**	**58,7**	**12312**	**266097**	**74426**	**120**	**794**	**33232**	**433**	**29521**	**122,3**	**3,36**	**0,593**

Users



Climate change - GWP100



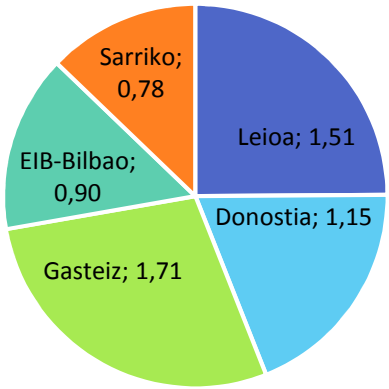
✓Carbon footprint seems to be higher in Leioa and Gasteiz than in Bilbao and Donostia.

RESULTS AND DISCUSSION

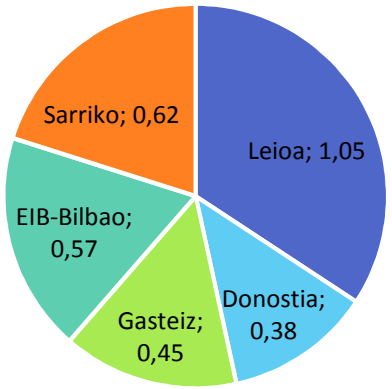
ENVIRONMENTAL IMPACTS – UPV/EHU, annual impacts per user

		Terrestrial ecotoxicity	Ozone layer depletion	Climate change GWP100	Photochem. Oxidation high Nox	Acidification potential	Eutro-phication	Marine aquatic ecotoxicity	Depletion of abiotic resources - fossil fuels	Human toxicity	Depletion of abiotic resources - elements	Freshwater aquatic ecotoxicity	Human Health	Resources	Ecosystems
	Users	g 1,4-dichloro-benzene eq.	kg CFC-11 eq.	t CO_2 eq.	kg ethylene eq.	kg SO_2 eq.	kg PO_{4---} eq.	kt 1,4-dichloro-benzene eq.	GJ	t 1,4-dichloro-benzene eq.	g antimony eq.	t 1,4-dichloro-benzene eq.	DALY	M$	species·yr
Leioa	15024	6,55	0,237	1,53	0,32	7,05	1,95	4,80	20,2	0,89	9,99	1,05	0,00314	85,2	0,000015
Donostia	11879	5,39	0,184	1,15	0,26	5,22	1,50	1,04	15,8	0,68	10,18	0,38	0,00244	67,4	0,000012
Gasteiz	8396	6,52	0,268	1,71	0,33	7,30	1,91	1,36	23,5	0,78	9,17	0,45	0,00345	98,1	0,000017
EIB-Bilbao	5865	4,39	0,143	0,90	0,20	4,40	1,34	2,53	11,9	0,60	10,24	0,57	0,00197	51,5	0,000010
Sarriko	3441	3,62	0,123	0,78	0,16	3,24	1,00	2,82	10,5	0,51	7,24	0,62	0,00162	45,3	0,000008
UPV/EHU	**44605**	**5,73**	**0,207**	**1,32**	**0,28**	**5,97**	**1,67**	**2,70**	**17,8**	**0,75**	**9,71**	**0,66**	**0,00274**	**75,4**	**0,000013**

Climate change - GWP100 (t CO2 eq.)



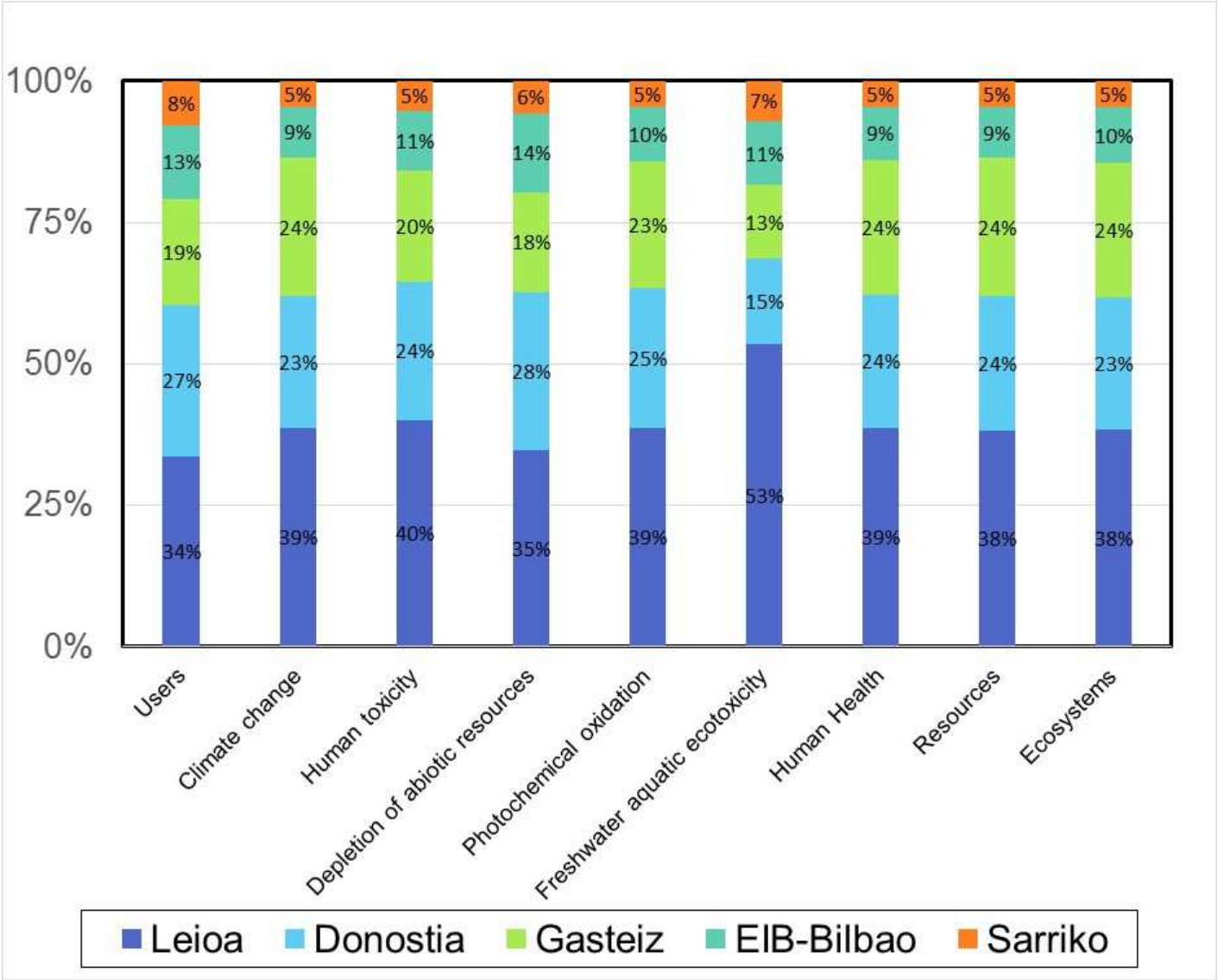
Freshwater aquatic ecotoxicity (t 1,4- dichlor. eq.)



✓ High *carbon footprint (Climate Change)* in Gasteiz,
and very high *freshwater aquatic ecotoxicity* in Leioa. What is happening?

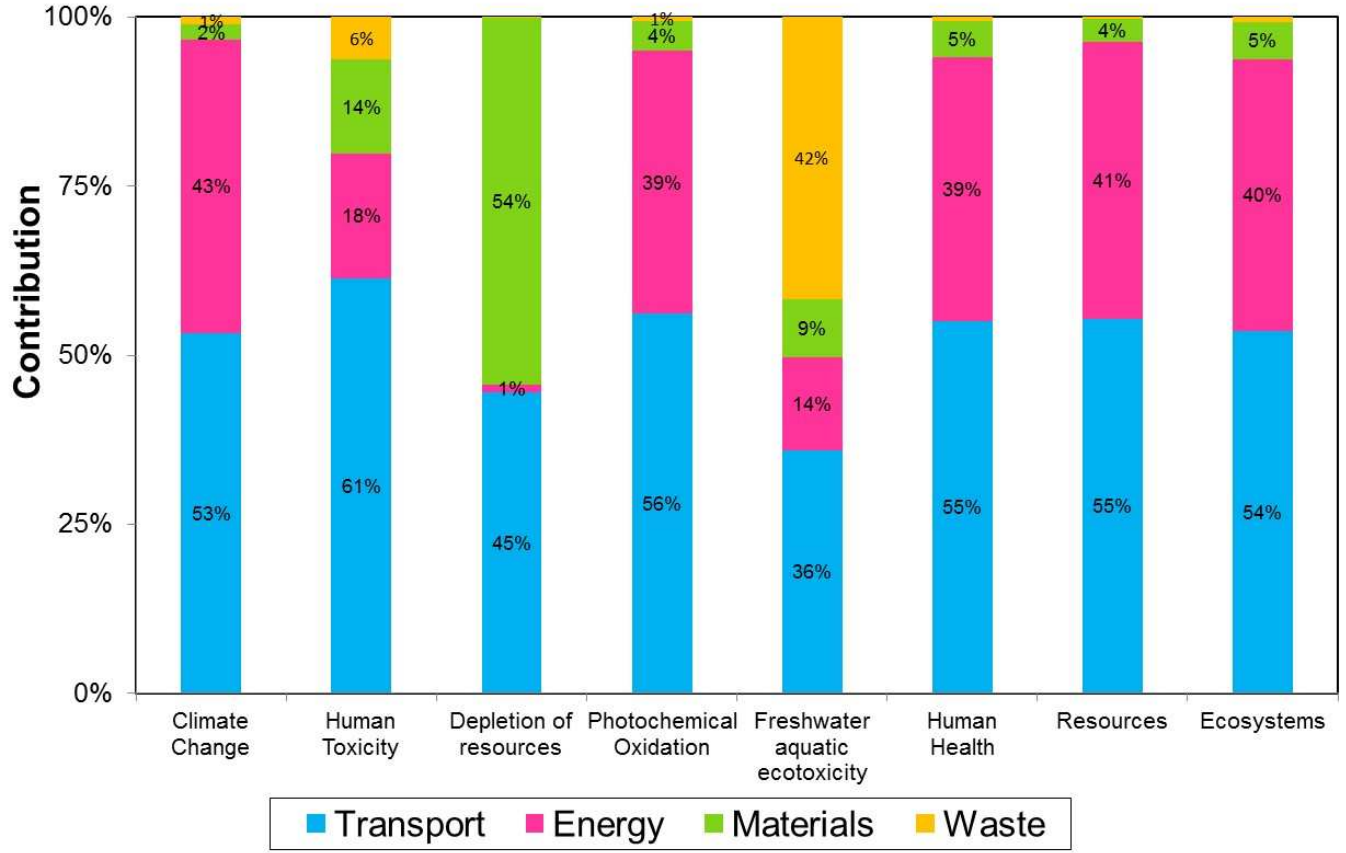
RESULTS AND DISCUSSION

ENVIRONMENTAL IMPACTS – UPV/EHU, % of impacts by Campus



RESULTS AND DISCUSSION

ENVIRONMENTAL IMPACTS - UPV/EHU, Contribution by subprocesses



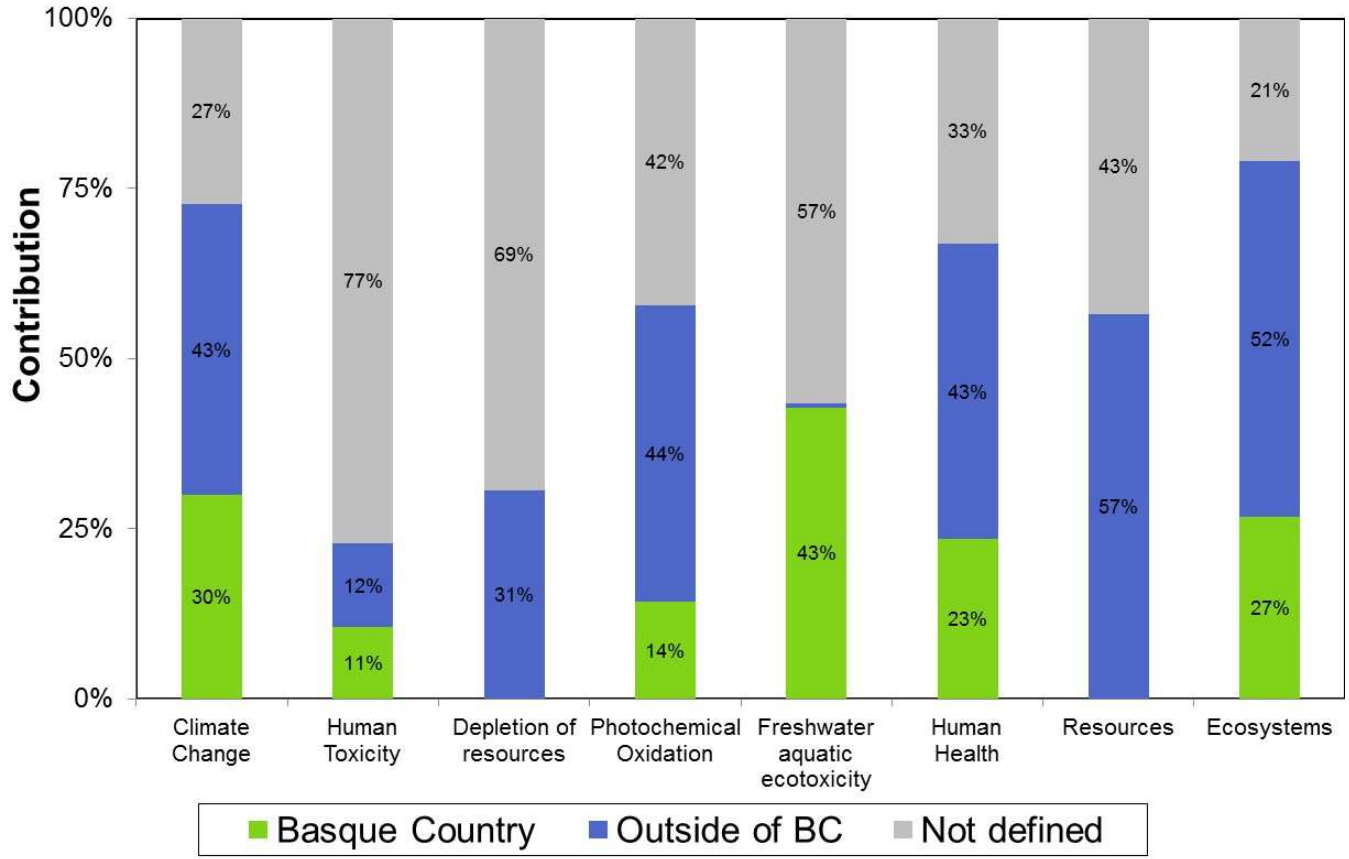
✓Half of impacts related to **Transport**.

✓High contribution of **Materials consumption** to *Depletion of abiotic resources –elements*.

✓High contribution of **Waste treatment** to *Freshwater aquatic ecotoxicity*.

RESULTS AND DISCUSSION

ENVIRONMENTAL IMPACTS – UPV/EHU, Contribution by location

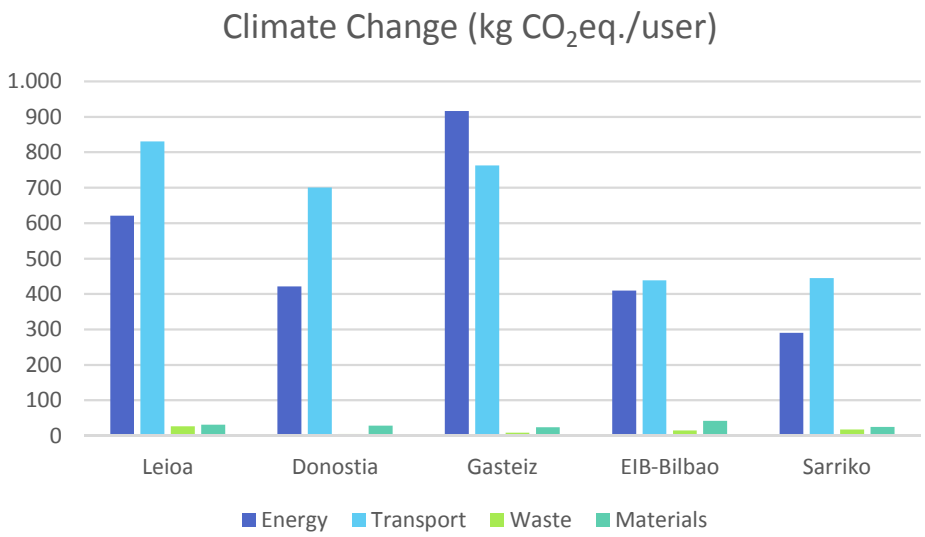


✓Unable to locate a big fraction of impacts (probably out of the Basque Country).

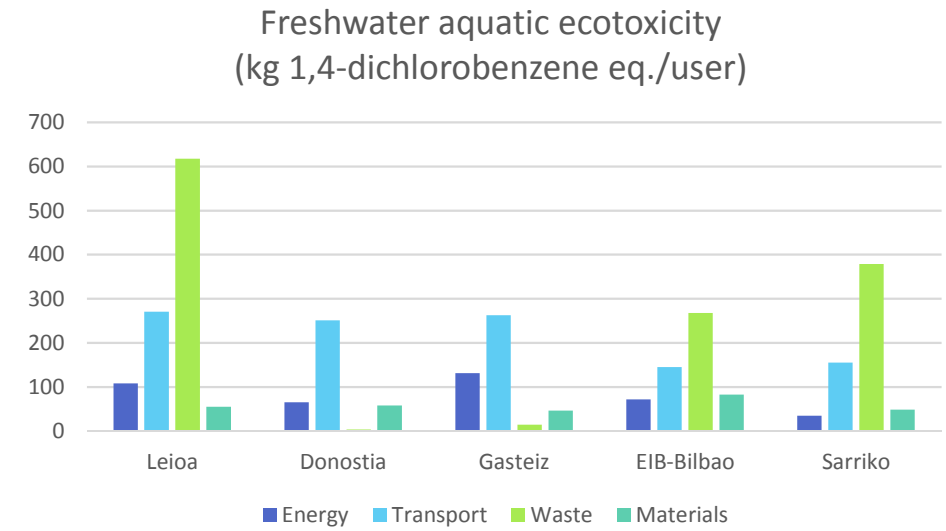
✓Many impacts located outside the Basque Country.

✓43% of *Freshwater aquatic ecotoxicity* impact (waste) located in the Basque Country.

ENVIRONMENTAL IMPACTS - Contribution by subprocesses



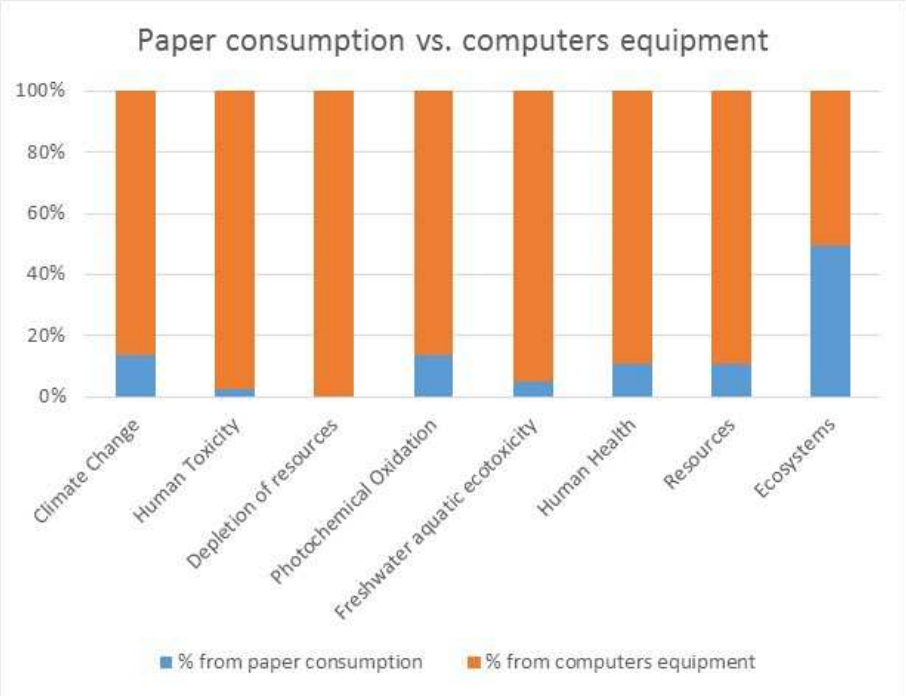
- ✓**Transport** impacts higher in Leioa, Gasteiz and Donostia (more on this later).
- ✓**Energy** consumption higher in Gasteiz (climatic effect?).

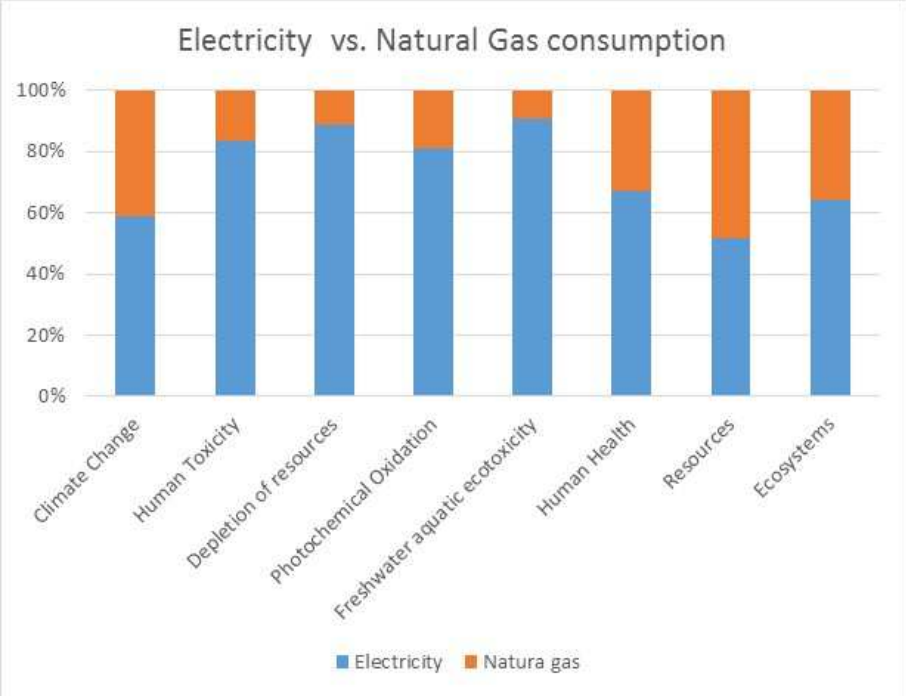


- ✓*Freshwater aquatic ecotoxicity* impact very high in Leioa because 100% of residual waste is incinerated (less in Bilbao, none in Donostia and Gasteiz).

RESULTS AND DISCUSSION

ENVIRONMENTAL IMPACTS - Leioa



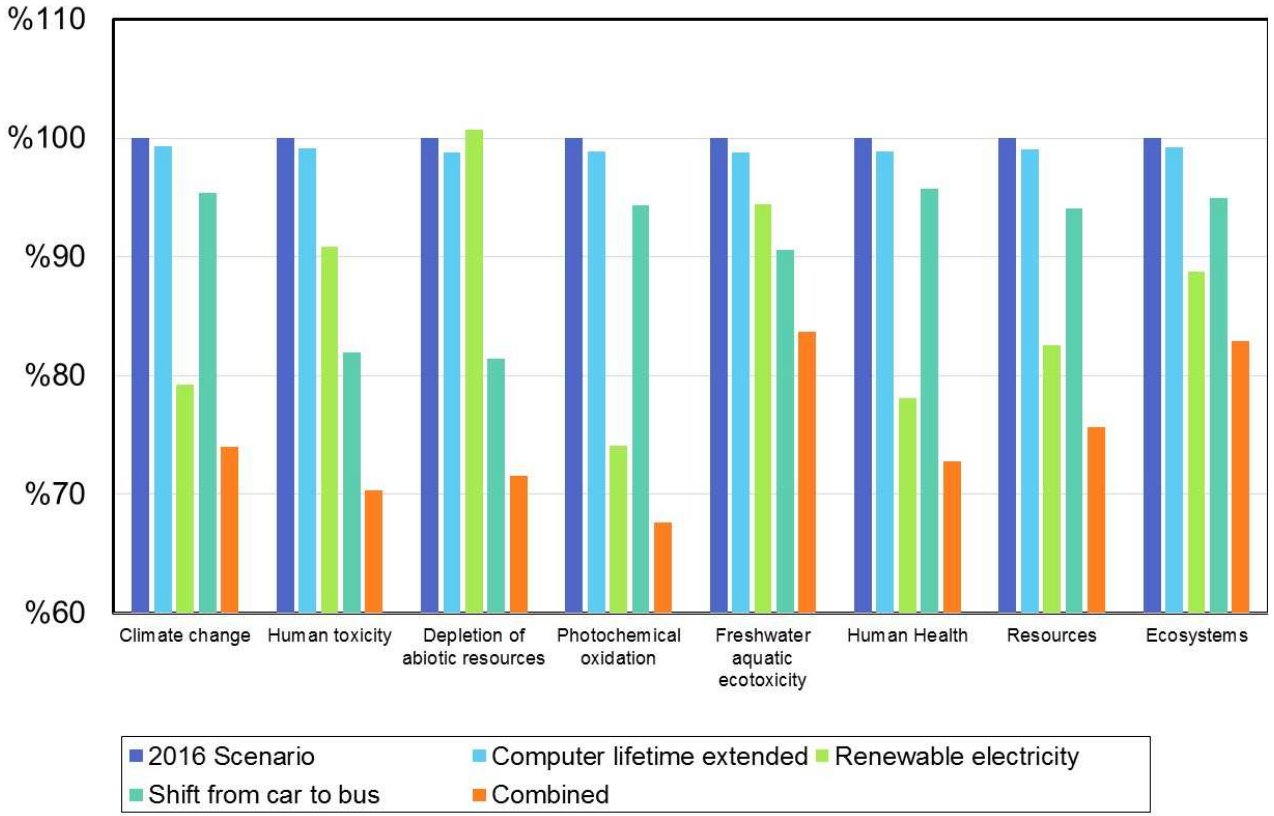


✓Impacts derived from computer manufacturing (desktops, laptops, screens) are much more important than those derived from paper production.

✓Impacts derived from natural gas supply (extraction, transport) and consumption are smaller than those derived from electricity production, but also very significant.

RESULTS AND DISCUSSION

ENVIRONMENTAL IMPACTS – UPV/EHU, Comparison of scenarios



Computer lifetime extended: +2 years (conputers, laptops 7->9 years; screens 14->16 years).
Renewable electricity: all consumed electricity comes from renewable resources (Spanish mix).
Shift from car to bus: half on transport by private car moves to public bus.
Combined: all previous measures considered.

TRANSPORT ANALYSIS– Survey results

- ✓ **Two users groups:** Staff and Students
- ✓ **Means of transport:** airplane, train, intercity and urban bus, tram, metro, car, motorcycle, bicycle and by foot
- ✓ **Types of transport:** daily commuting, change of residence displacement and work displacements
- ✓ **Unit of transport measurement:** passenger·kilometer (for one academic year)

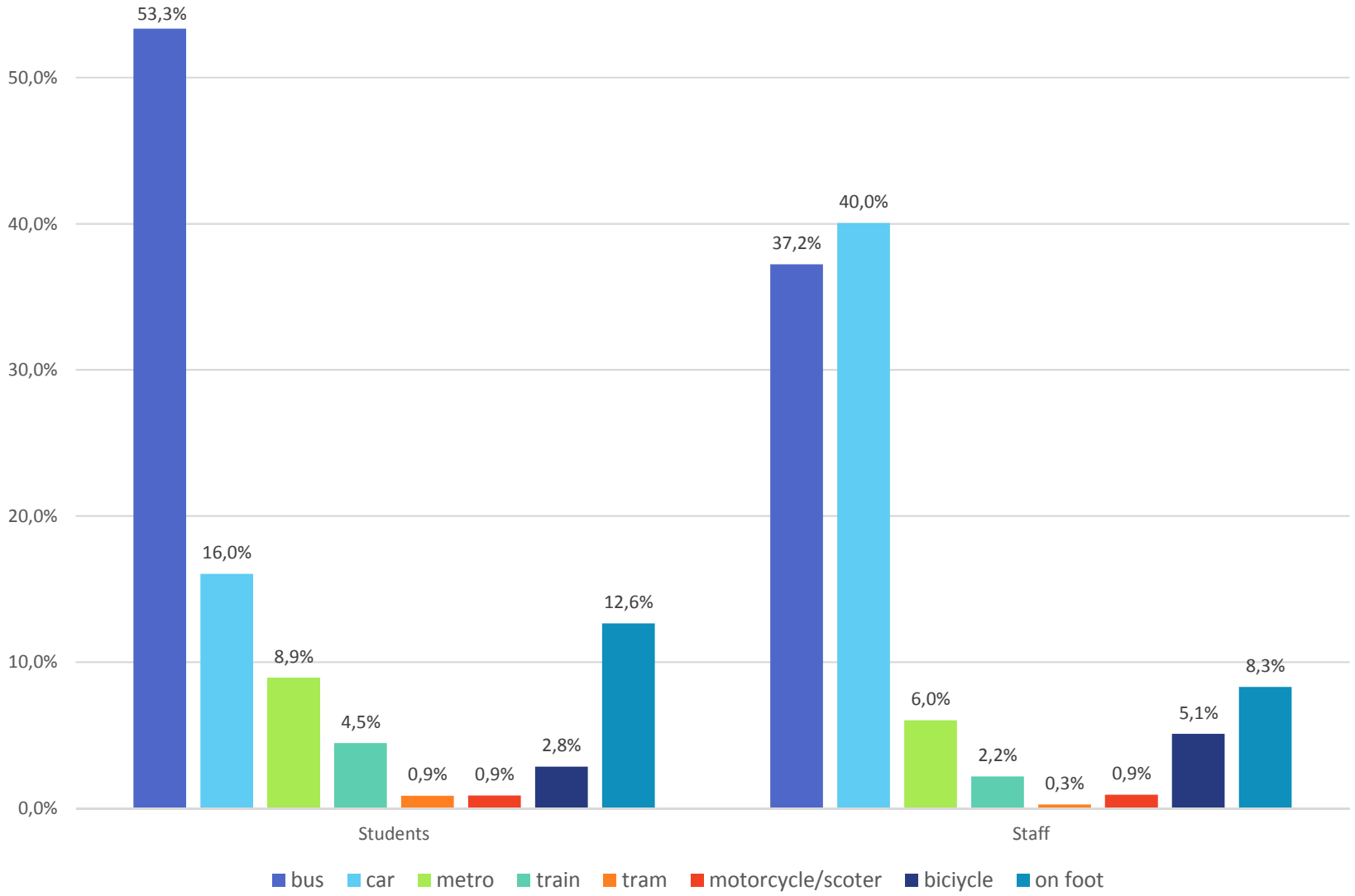
Groups of Users	Responses	Population from 2016/17	Margin of error
Students	2.966	39.018	1.7%
Staff	603	8.178	3.8%

Answers gathered in the survey by groups, population and margin of error.

RESULTS AND DISCUSSION

TRANSPORT ANALYSIS– Survey results

Means of transport (% of the people)

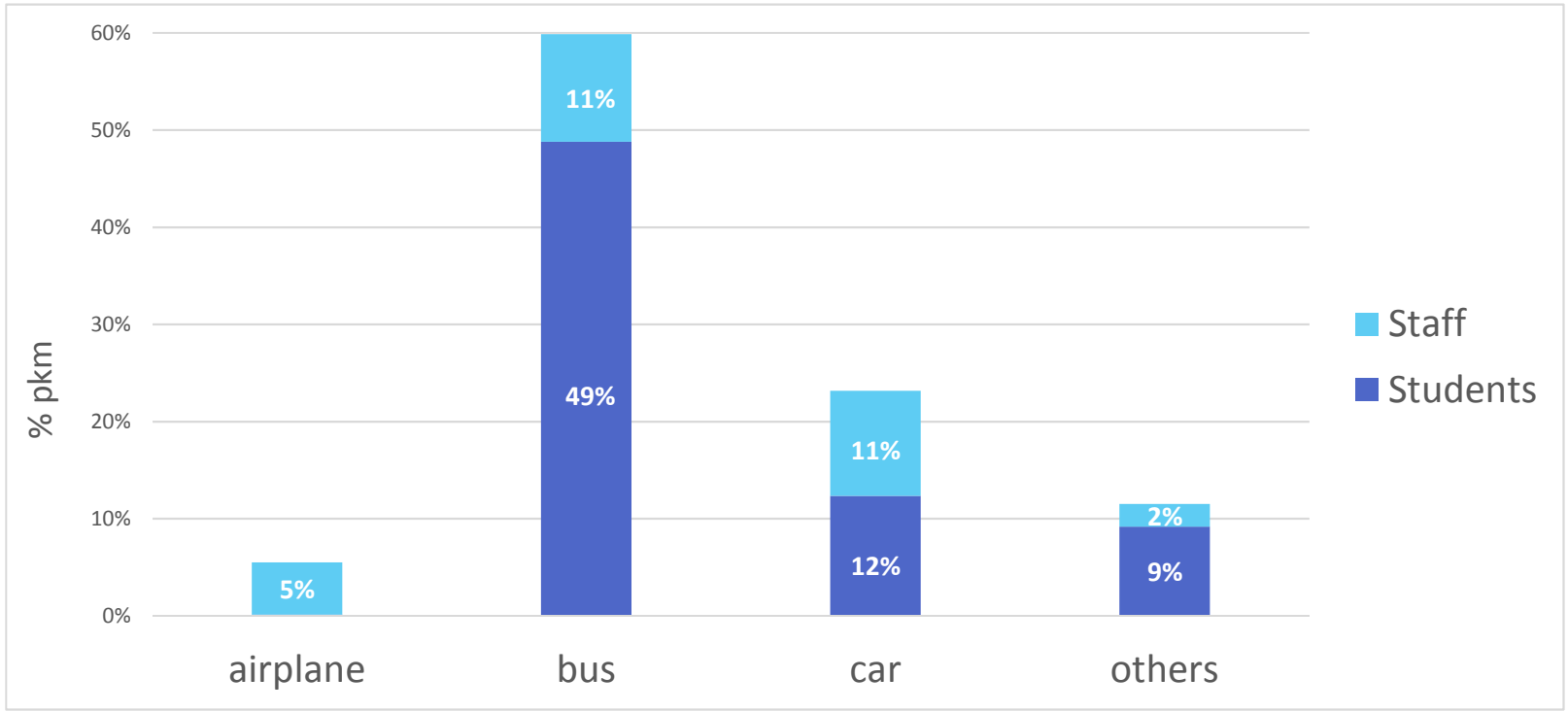


RESULTS AND DISCUSSION

TRANSPORT ANALYSIS– Survey results

Distribution of total transport according to type of transport (% of pkm)

	Daily Commuting	Change of residence	Work transport
Students	60%	10%	0%
Staff	20%	1%	9%



Distribution of total transport according to passenger-kilometers (pkm)

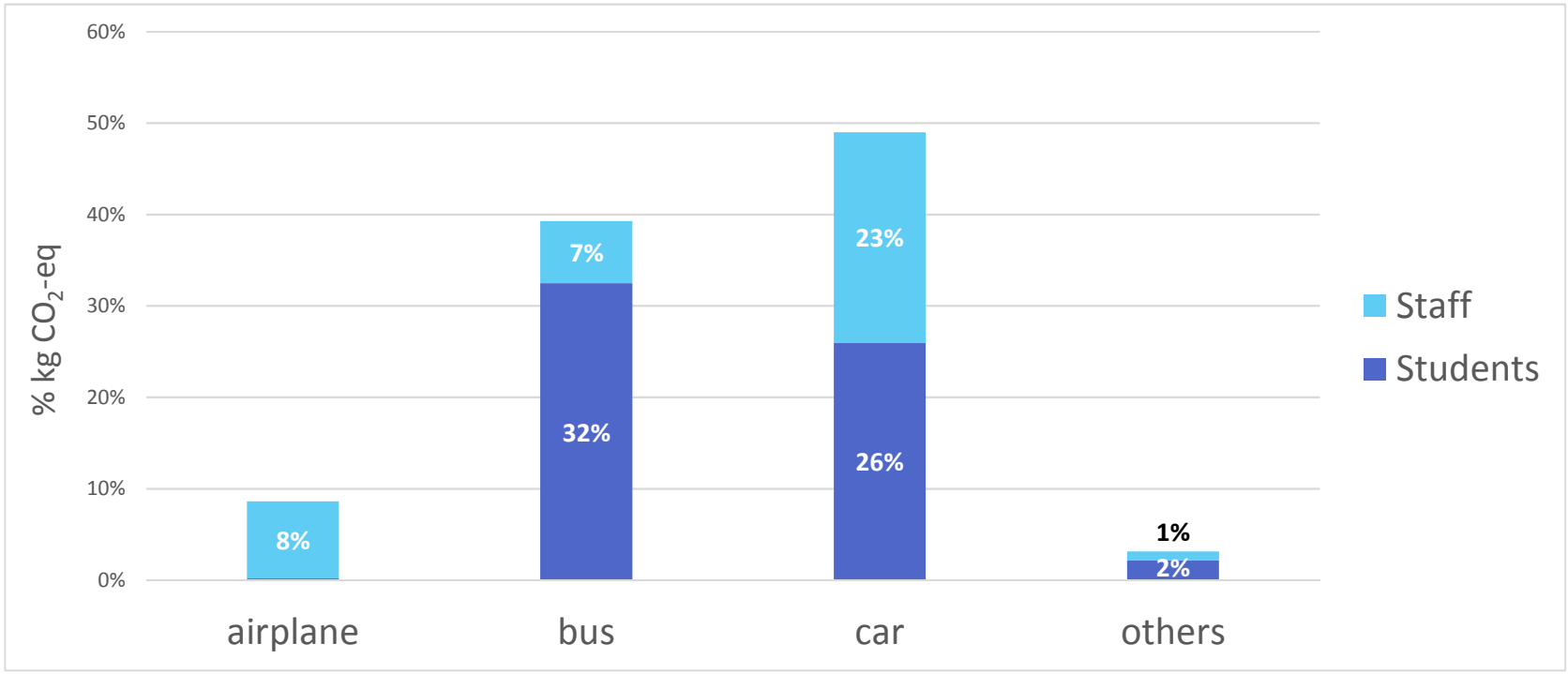
RESULTS AND DISCUSSION

TRANSPORT ANALYSIS– Environmental impacts

CLIMATE CHANGE-GLOBAL WARMING

Groups of Users	Impact per person
Students	599 kg CO_2-eq/person
Staff	2043 kg CO_2-eq/person

STUDENTS × 3 ≈ STAFF



Distribution of climate change impacts according to means of transport and user groups

RESULTS AND DISCUSSION

TRANSPORT ANALYSIS– Environmental impacts

HUMAN TOXICITY

Groups of Users	Impact per person
Students	359 kg 1,4-dichlorobenzene eq.
Staff	1709 kg 1,4-dichlorobenzene eq.

STUDENTS × 5 ≈ STAFF

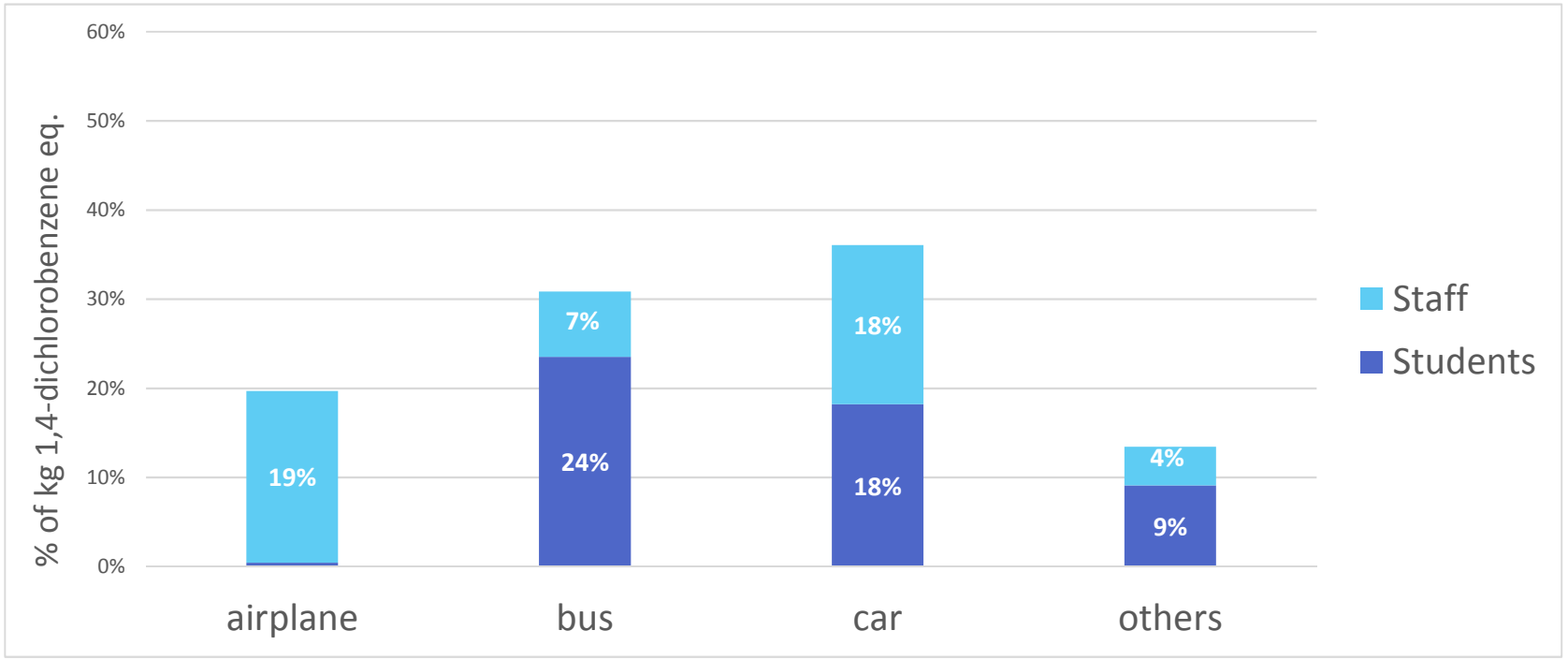


Figure X. Distribution of human toxicity impacts according to means of transport and user groups

RESULTS AND DISCUSSION

TRANSPORT ANALYSIS– Environmental impacts

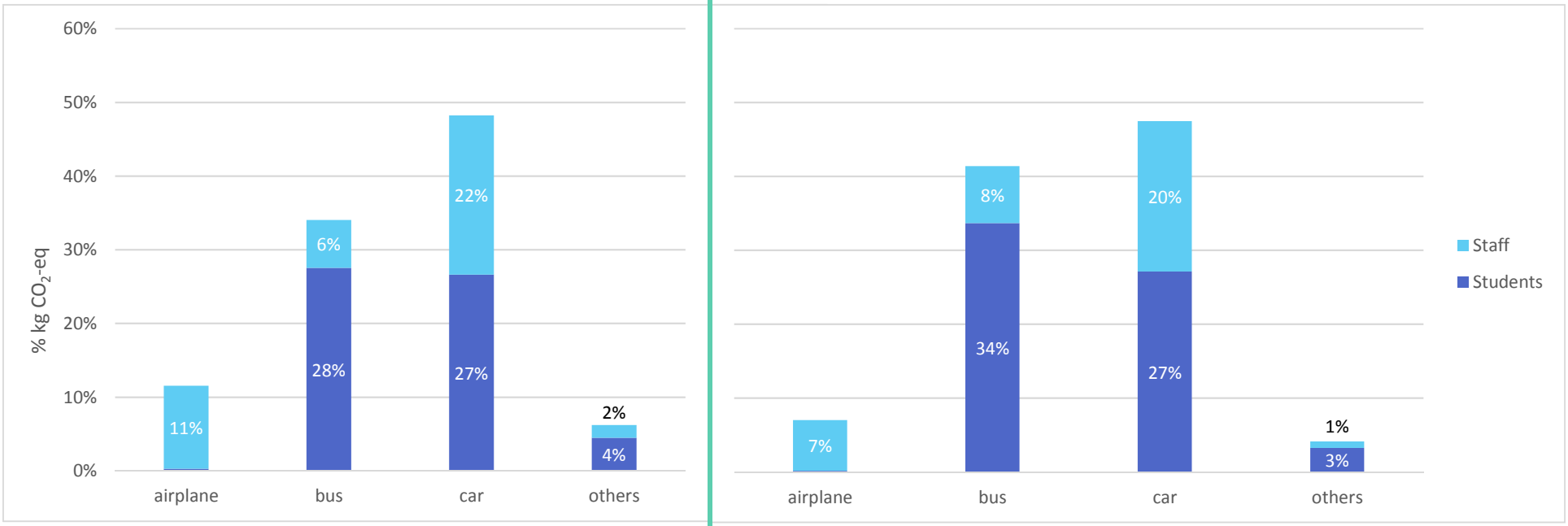
CLIMATE CHANGE-GLOBAL WARMING IMPACTS FOR DIFFERENT CAMPUS

BILBAO

Groups of Users	Impact per person
Students	371 kg CO_2-eq/person
Staff	1603 kg CO_2-eq/person

GASTEIZ

Groups of Users	Impact per person
Students	689 kg CO_2-eq/person
Staff	2291 kg CO_2-eq/person



TRANSPORT ANALYSIS– Proposal of scenarios

What if PRIVATE transport goes to PUBLIC transport?

Climate Change

Groups of Users	Impact per person Today scenario	Impact per person PUBLIC TRANSPORT scenario	% Reduction
Students	599 kg CO_2-eq/person	465 kg CO_2-eq/person	**22%**
Staff	2043 kg CO_2-eq/person	1424 kg CO_2-eq/person	**30%**
Total	2642 kg CO_2-eq/person	1889 kg CO_2-eq/person	29%

Human Toxicity

Groups of Users	Impact per person Today scenario	Impact per person PUBLIC TRANSPORT scenario	% Reduction
Students	359 kg 1,4-dichlorobenzene eq.	172 kg 1,4-dichlorobenzene eq.	**52%**
Staff	1709 kg 1,4-dichlorobenzene eq.	865 kg 1,4-dichlorobenzene eq.	**49%**
Total	2068 kg 1,4-dichlorobenzene eq.	1037 kg 1,4-dichlorobenzene eq.	50%

TRANSPORT ANALYSIS– Proposal of scenarios

Changing the PLACE OF RESIDENCE to the WORK PLACE

Climate Change

Groups of Users	Impact per person Today scenario	Impact per person PUBLIC TRANSPORT scenario	% Reduction
Students	599 kg CO_2-eq/person	491 kg CO_2-eq/person	**18%**
Staff	2043 kg CO_2-eq/person	1966 kg CO_2-eq/person	**4%**
Total	2642 kg CO_2-eq/person	2457 kg CO_2-eq/person	7%

Human Toxicity

Groups of Users	Impact per person Today scenario	Impact per person PUBLIC TRANSPORT scenario	% Reduction
Students	359 kg 1,4-dichlorobenzene eq.	324 kg 1,4-dichlorobenzene eq.	**10%**
Staff	1709 kg 1,4-dichlorobenzene eq.	1728 kg 1,4-dichlorobenzene eq.	**-1%**
Total	2068 kg 1,4-dichlorobenzene eq.	2052 kg 1,4-dichlorobenzene eq.	1%

TRANSPORT ANALYSIS– Proposal of scenarios

Changing to a 4-DAY WORKING WEEK

Climate Change

Groups of Users	Impact per person Today scenario	Impact per person PUBLIC TRANSPORT scenario	% Reduction
Students	599 kg CO_2-eq/person	501 kg CO_2-eq/person	**16%**
Staff	2043 kg CO_2-eq/person	1800 kg CO_2-eq/person	**12%**
Total	2642 kg CO_2-eq/person	2301 kg CO_2-eq/person	7%

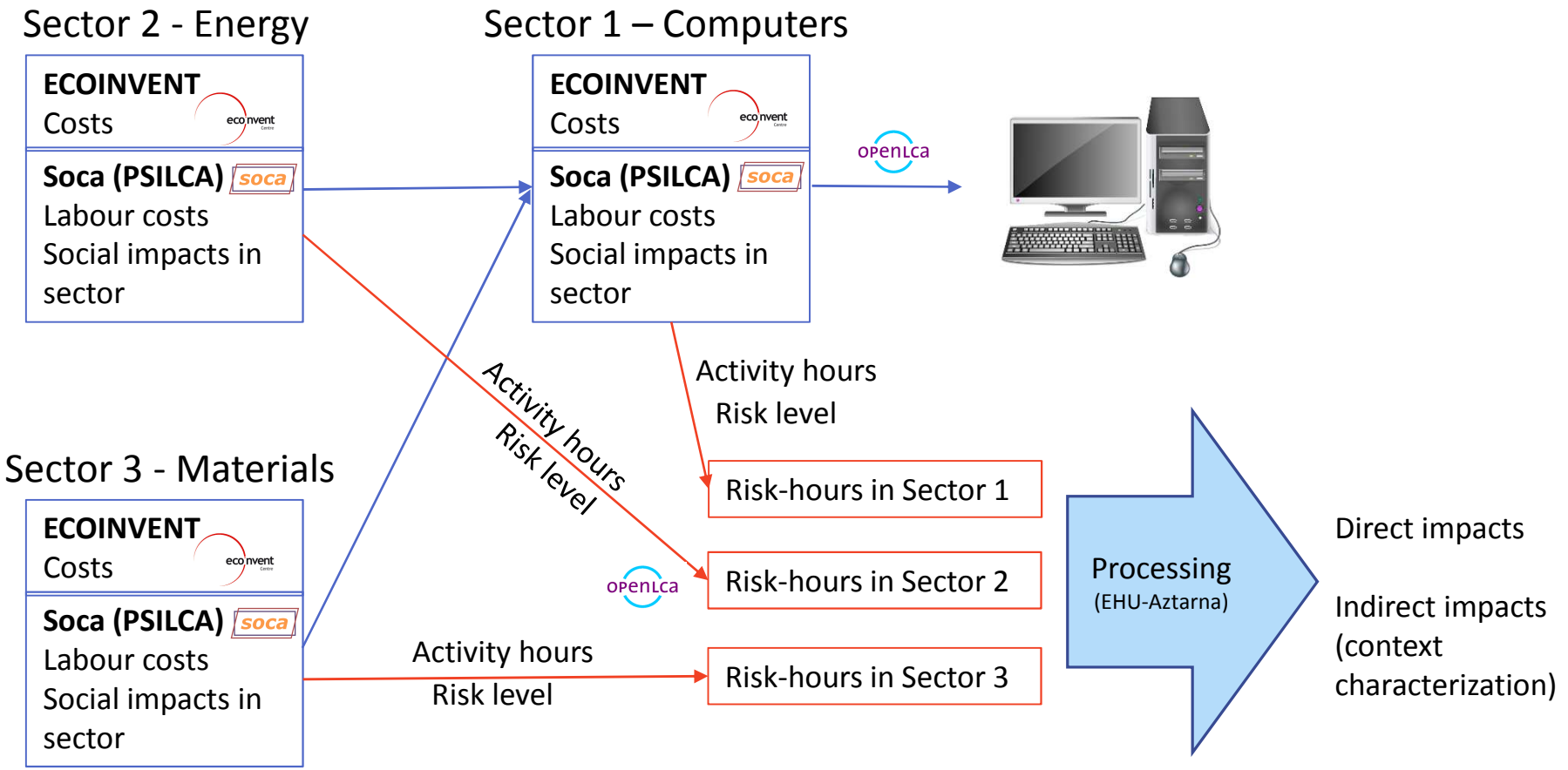
Human Toxicity

Groups of Users	Impact per person Today scenario	Impact per person PUBLIC TRANSPORT scenario	% Reduction
Students	359 kg 1,4-dichlorobenzene eq.	302 kg 1,4-dichlorobenzene eq.	**16%**
Staff	1709 kg 1,4-dichlorobenzene eq.	1504 kg 1,4-dichlorobenzene eq.	**12%**
Total	2068 kg 1,4-dichlorobenzene eq.	1806 kg 1,4-dichlorobenzene eq.	13%

RESULTS AND DISCUSSION

SOCIAL IMPACTS – Processing with openLCA & soca

An example: calculation of social impacts derived from the manufacturing of a computer



(processing for each social impact category)

RESULTS AND DISCUSSION

SOCIAL IMPACTS (13 selected from 37) – UPV/EHU

Stakeholders	Impact category		Description
Local Community	Certified environmental management system	Indirect	Number of certified environmental management systems per sector
	Indigenous rights		Qualitative indicator (describes and assess the legal situation of indigenous people)
	Pollution		Numbeo index (average of subjective perception of pollution, 0-100)
	Unemployment		Percentage of persons unemployed
Society	Education		Public expenditure on education as % of GDP
	Health expenditure		Health expenditure as % GDP
	Illiteracy		Average % of population > 15 years that cannot correctly read nor write
Value Chain Actors	Corruption		Corruption Perceptions index (perceived level of publuc sector corruption, 0 – 100)
Workers	Child Labour, total		Average % of children 7-14 years that perform at least 1h of work per week
	Gender wage gap		Percentage of the wage gap between men and women
	Weekly hours of work per employee		Mean weekly hours actually worked per employee
	Fatal accidents	Direct	Fatal accidents/year
	Non-fatal accidents		Non-fatal accidents/year
Costs			Cost/year

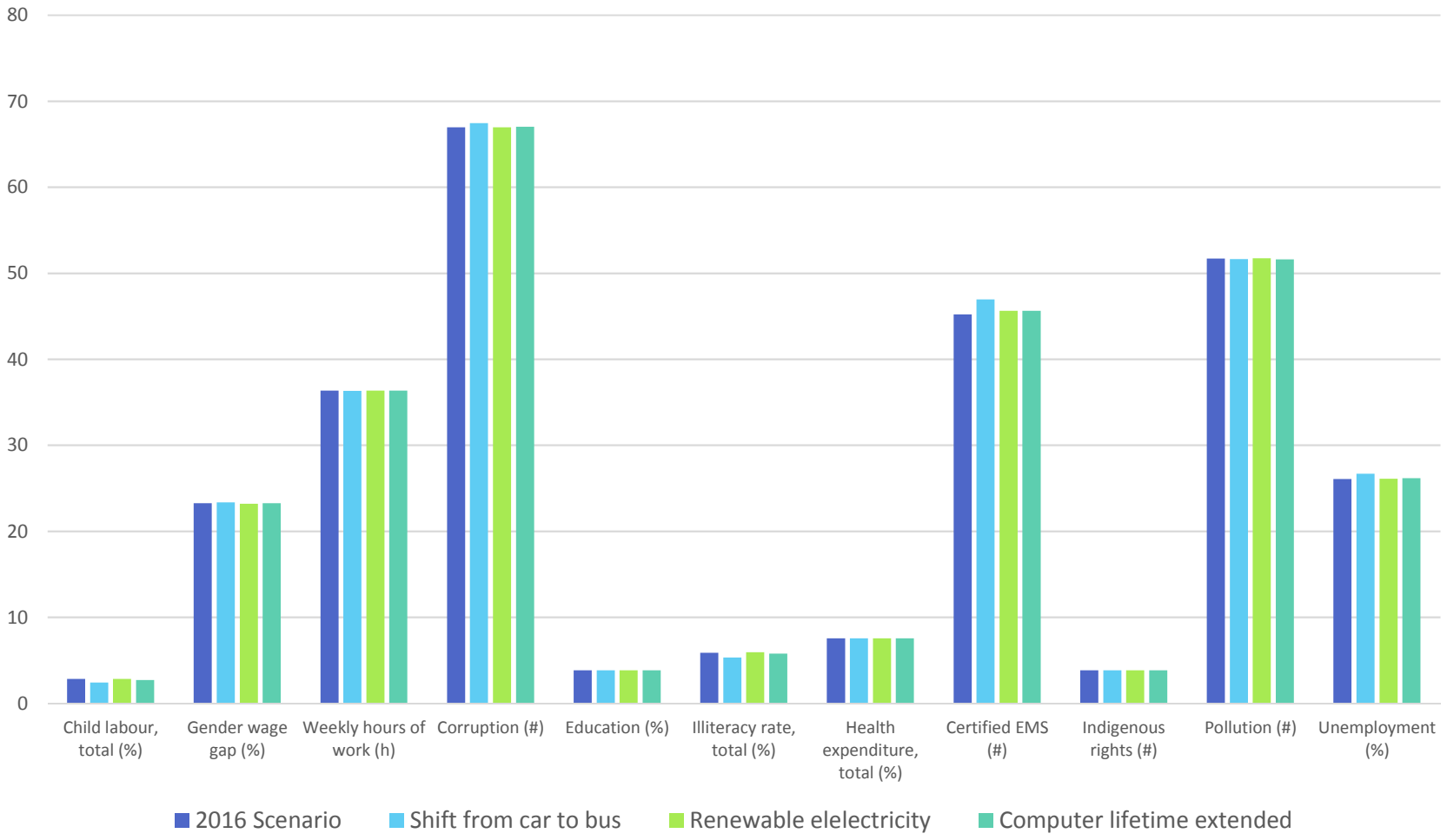
RESULTS AND DISCUSSION

SOCIAL IMPACTS (13 selected from 37) – UPV/EHU

Impact category		Raw value	Description
Certified environmental management system	Indirect	45,2	Number of certified environmental management systems per sector
Indigenous rights		3,83/4	Qualitative indicator (describes and assess the legal situation of indigenous people) (Spain: 4/4)
Pollution		51,69	Numbeo index (average of subjective perception of pollution, 0-100) (Spain: 32/100)
Unemployment		26%	Percentage of persons unemployed (Euskadi: 13,4%)
Education		3,85%	Public expenditure on education as % of GDP (Euskadi: 5%)
Health expenditure		7,54%	Health expenditure as % GDP (Euskadi: 8,7%)
Illiteracy		5,88%	Average % of population > 15 years that cannot correctly read nor write (Euskadi: 0,36%)
Corruption		66,95	Corruption Perceptions index (perceived level of publuc sector corruption, 0 – 100) (Spain: 65/100)
Child Labour, total		2,82%	Average % of children 7-14 years that perform at least 1h of work per week (Spain: 0%)
Gender wage gap		23,25%	Percentage of the wage gap between men and women (Spain: 24,3%)
Weekly hours of work per employee		36,35	Mean weekly hours actually worked per employee (Spain: 36h)
Fatal accidents	Direct	0,75	Fatal accidents/year
Non-fatal accidents		145	Non-fatal accidents/year
Costs		309 M€	Cost/year

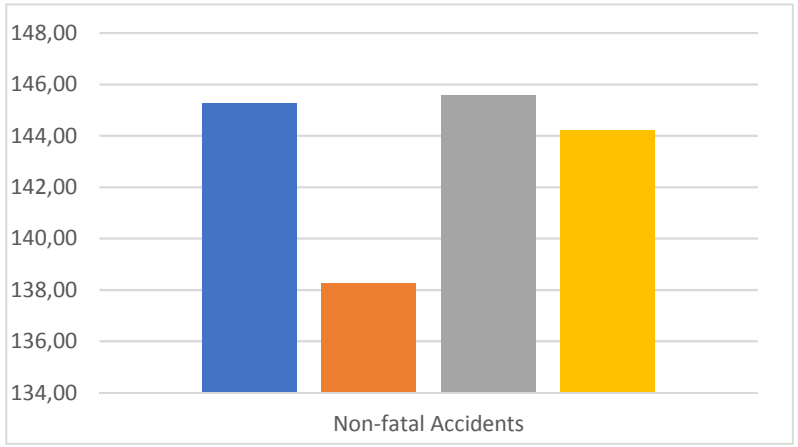
RESULTS AND DISCUSSION

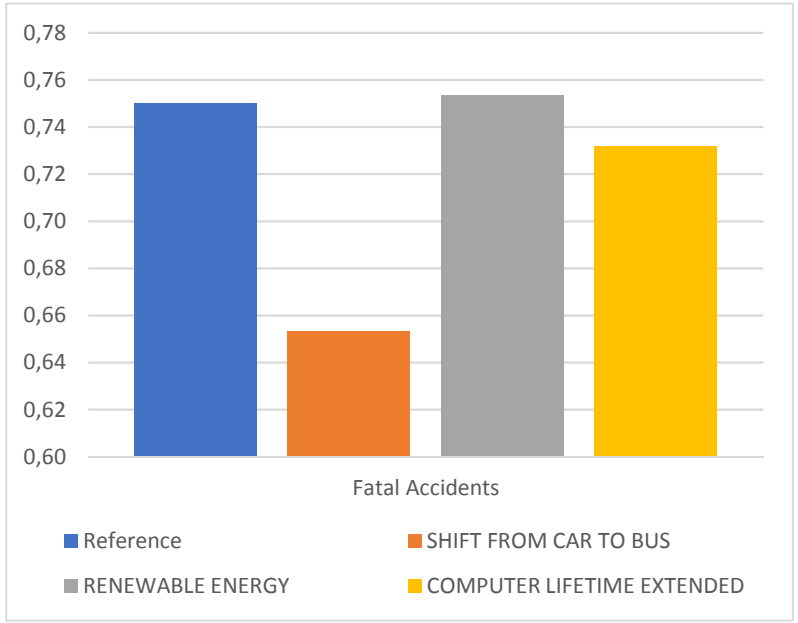
SOCIAL IMPACTS (11 indirect impacts) – UPV/EHU, Comparison of Scenarios

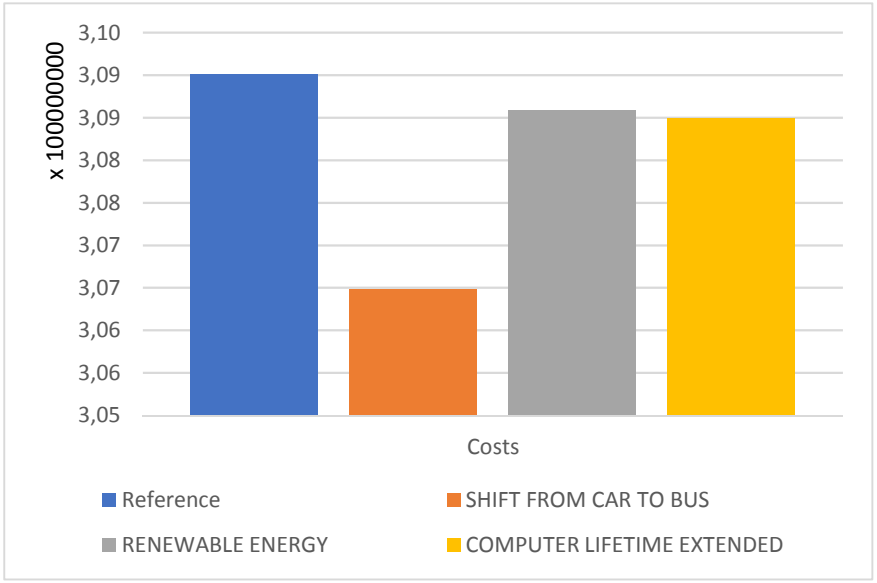


RESULTS AND DISCUSSION

SOCIAL IMPACTS (3 direct impacts) – UPV/EHU, Comparison of Scenarios







CONCLUSIONS

- ✓ The project is a valid tool for better aligning the academic activity of the UPV/EHU with the Sustainable Development Goals. Actually, almost all SDG are covered to some extent by indicators considered in EHU-Aztarna.

CONCLUSIONS

- ✓ A technology and a methodology for the assessment of the Environmental and Social Footprint of Organizations has been acquired.
- ✓ Collection of inventory data has been very problematic.
- ✓ Transport contribution to environmental impacts is very important (~50%).
- ✓ Contributions from subprocesses vary according to the impact category considered (waste treatment dominates *freshwater ecotoxicity*; materials consumption *metals depletion*; energy and transport *climate change*).
- ✓ A significant portion of impacts are located outside the Basque Country in most of the environmental impact categories considered (*climate change, depletion of resources*...).
- ✓ Impact derived from computers supply is much more important than from paper supply; natural gas consumption is also very important (not all energy consumption is electricity); direct incineration of residual waste should be avoided.

CONCLUSIONS

- ✓ Students use more sustainable means of transport: bus is the most used means of transport.
- ✓ Students' individual environmental impact is remarkably lower than staff's impact.
- ✓ Staff, which is only 15% of the total population, has the 40% of the total climate change impact.
- ✓ The use of alternative means of transport for daily commuting (car -› public transport) can potentially minimize environmental impacts.
- ✓ This tool is useful to propose different improving transport scenarios in the UPV/EHU.

CONCLUSIONS

- ✓ The estimation of social impacts in the framework of the life cycle analysis is methodologically innovative. This work contributes empirically to progress in this regard.
- ✓ The estimated impacts show remarkable social consequences derived from the academic activity, an issue generally invisible.
- ✓ Many of the social impacts are located outside de Basque Country.
- ✓ Social impacts related to different scenarios for UPV/EHU do not have as many variations with respect to the current situation as the environmental impacts have.
- ✓ The results can serve as a basis for further investigations.

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- This work has been presented at various Congresses both in Spain and abroad.