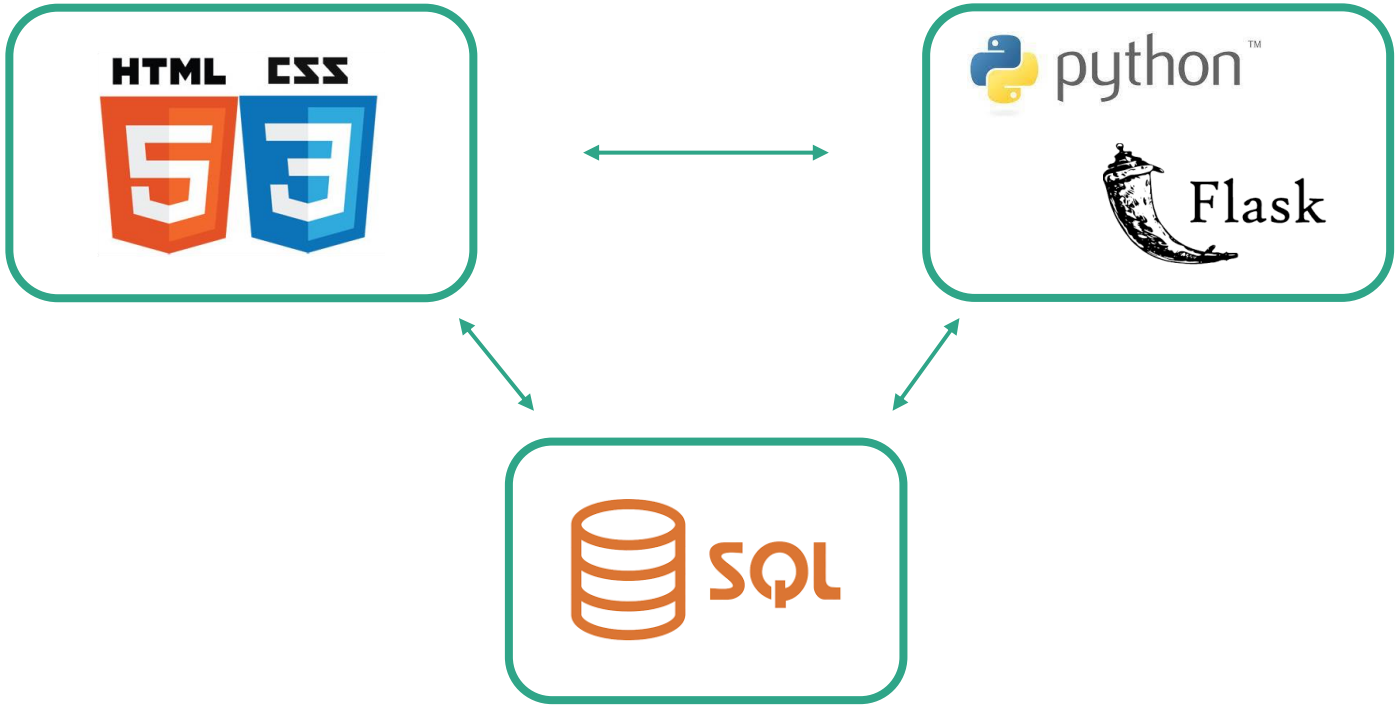
UNIVERSITÀ DEGLI STUDI FIRENZE

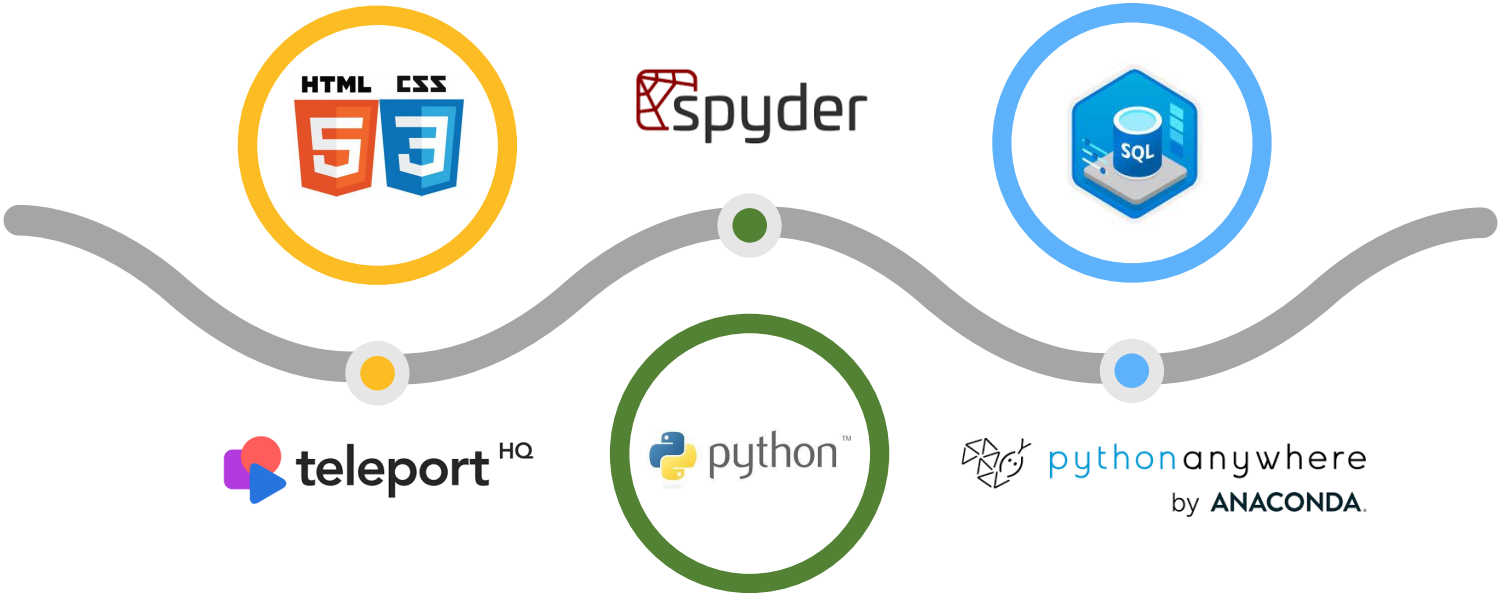
MES

A.Y. 2022-2023
Course: Sustainable Energy
Prof. Giampaolo Manfrida
Ing. Alessia Manfredi
Candidates: Gradi Pietro, Hosen Farid, Nardomarino Valerio

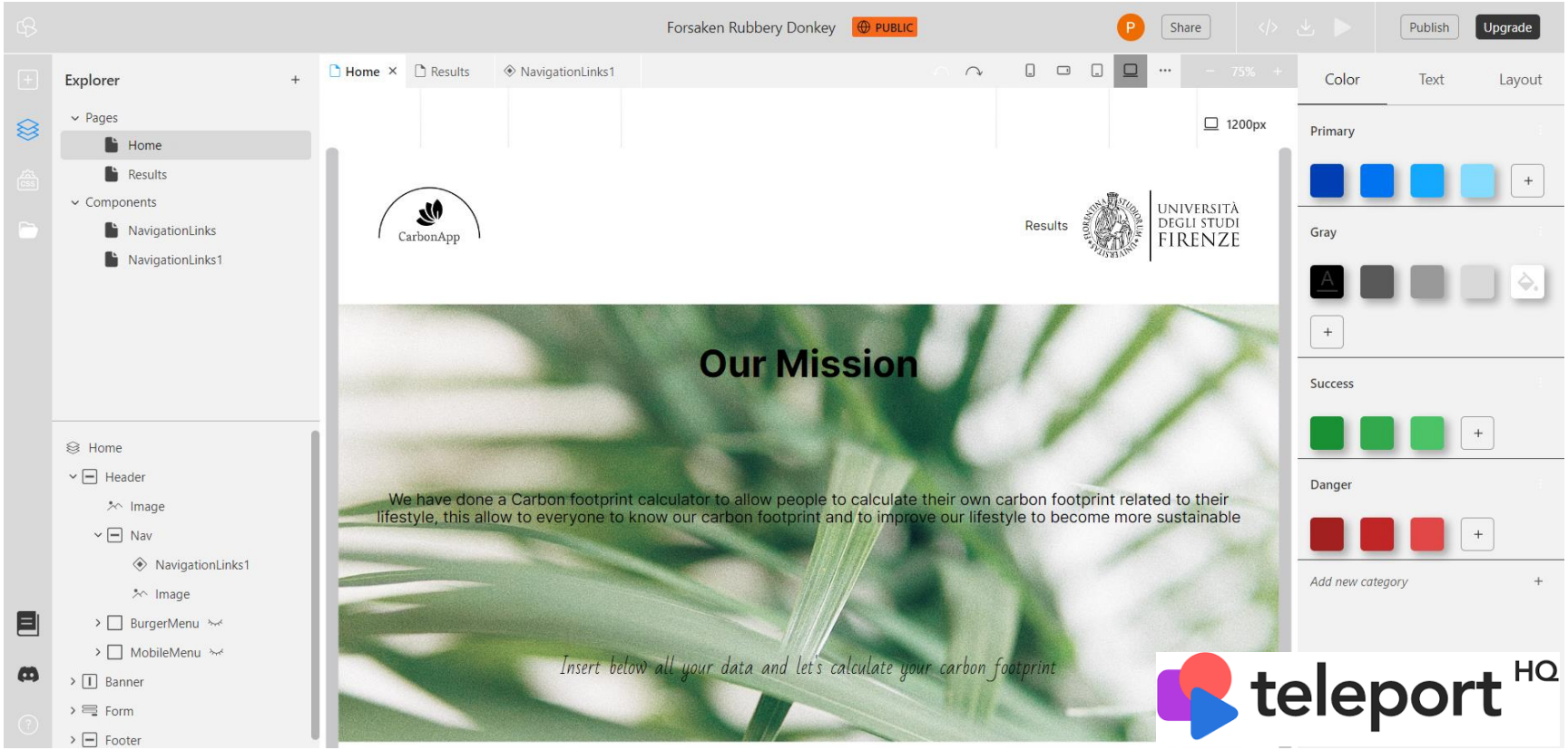
Site structure



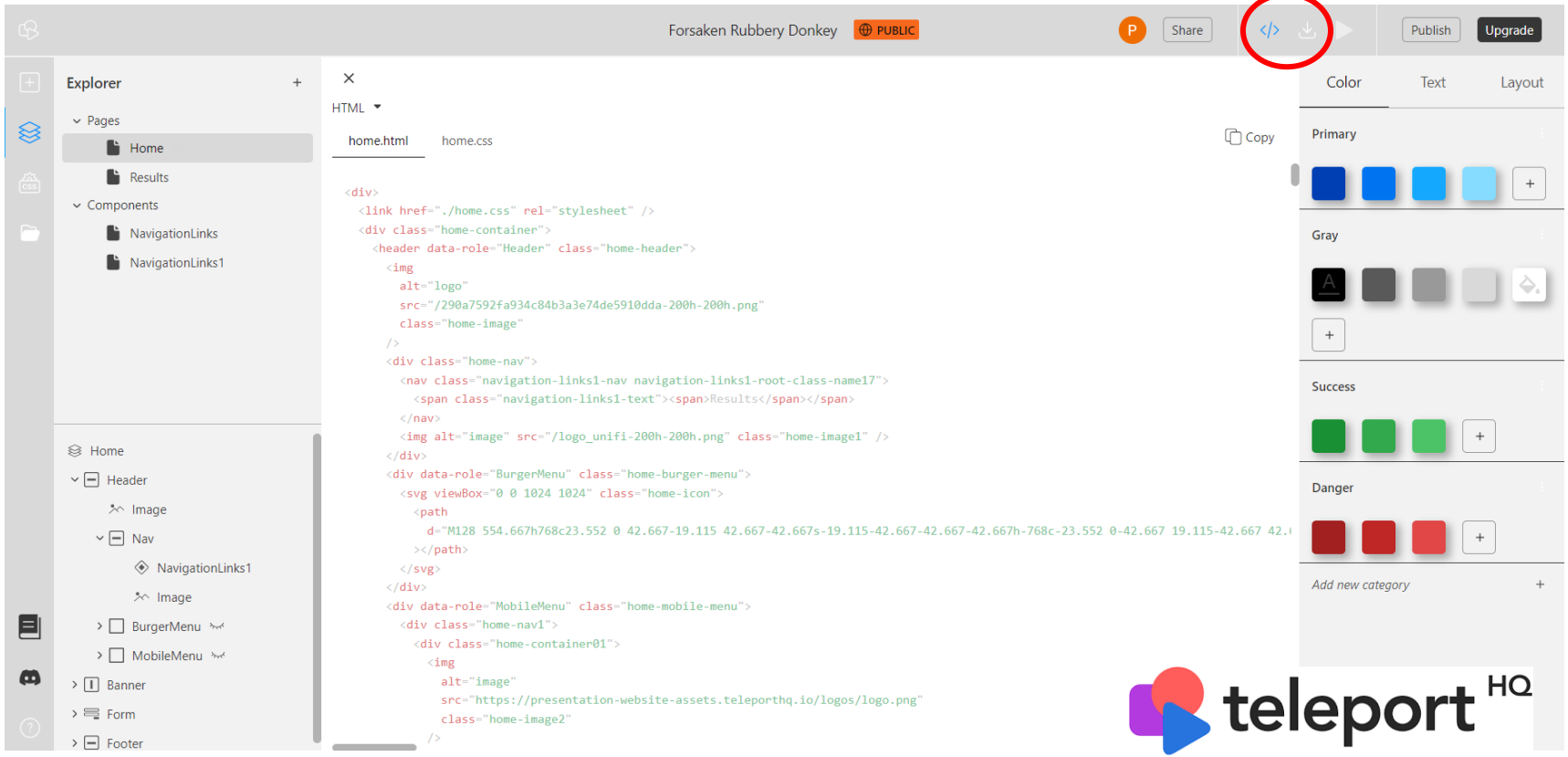
Tools


HTML
CSS
spyder
SQL
teleport HQ
python
pythonanywhere
by ANACONDA.

Teleport


Forsaken Rubbery Donkey
PUBLIC
Share
Publish
Upgrade
Explorer
Pages
Home
Results
Components
NavigationLinks
NavigationLinks1
Home
Results
NavigationLinks1
75%
1200px
Color
Text
Layout
Primary
Gray
Success
Danger
Add new category
CarbonApp
Results
UNIVERSITÀ DEGLI STUDI FIRENZE
Our Mission
We have done a Carbon footprint calculator to allow people to calculate their own carbon footprint related to their lifestyle, this allow to everyone to know our carbon footprint and to improve our lifestyle to become more sustainable
Insert below all your data and let's calculate your carbon footprint
Home
Header
Image
Nav
NavigationLinks1
Image
BurgerMenu
MobileMenu
Banner
Form
Footer
teleport HQ

Teleport


Forsaken Rubbery Donkey
PUBLIC
Share
Publish
Upgrade
Explorer
Pages
Home
Results
Components
NavigationLinks
NavigationLinks1
HTML
home.html
home.css
Copy

<link href="./home.css" rel="stylesheet" />

<header data-role="Header" class="home-header">
<img
alt="logo"
src="/290a7592fa934c84b3a3e74de5910dda-200h-200h.png"
class="home-image"
/>

<nav class="navigation-links1-nav navigation-links1-root-class-name17">
Results
</nav>

<svg viewBox="0 0 1024 1024" class="home-icon">
<path
d="M128 554.667h768c23.552 0 42.667-19.115 42.667-42.667s-19.115-42.667-42.667-42.667h-768c-23.552 0-42.667 19.115-42.667 42.667
></path>
</svg>

<img
alt="image"
src="https://presentation-website-assets.teleporthq.io/logos/logo.png"
class="home-image2"
/>
Home
Header
Image
Nav
NavigationLinks1
Image
BurgerMenu
MobileMenu
Banner
Form
Footer
Color
Text
Layout
Primary
Gray
Success
Danger
Add new category
teleport HQ

Directory of files

__pycache__	11/05/2023 10:37	Cartella di file	
static	08/05/2023 11:50	Cartella di file	
teleport	08/05/2023 11:50	Cartella di file	
templates	17/05/2023 15:47	Cartella di file	
carbon	17/05/2023 15:47	File PY	7 KB
function	11/05/2023 10:37	File PY	9 KB
output	17/05/2023 16:24	File con valori sep...	1 KB
results_download	17/05/2023 16:24	Foglio di lavoro di...	22 KB
template_results	20/05/2023 19:15	Foglio di lavoro di...	59 KB

Input data in HTML

```
<form class="home-form" method="POST" action="/results">
  <div class="home-container02">
    <span class="home-text003">
      Enter below what you eat in a typical week
    </span>
  </div>
  <div class="home-container03">
    <div class="home-container04">
      <h1 class="home-text004">Protein</h1>
      <div class="home-container05">
        <span class="home-text005">
          <span>Beef</span>
          <br />
          <span class="home-text008">(beef herd)</span>
          <br />
        </span>
        <input
          type="text"
          placeholder="[g/week]"
          class="home-textinput input"
          name="beef_herd"
        />
```

Python code

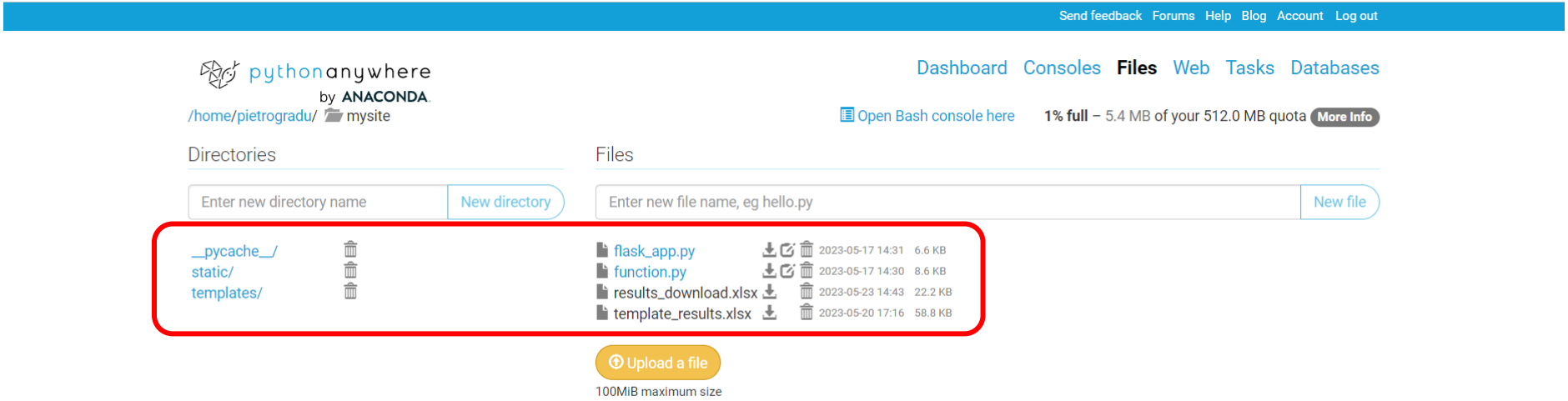
```
@app.route('/')
def home():
    if os.path.isfile('output.csv'):
        os.remove('output.csv')
    return render_template('index.html')
@app.route('/home')
def home1():
    return render_template('index.html')

@app.route('/results',methods = ['POST', 'GET'])
def result():
    if request.method == 'POST':
        dati_html=request.form
    return render_template('results.html',output= output)
```

Output data to HTML

```
<span class="results-text09">Total amount:</span>
<span class="results-text10">{{output[0]}}</span>
<span class="results-text11">[kgCO2/day]</span>
```

Pythonanywhere



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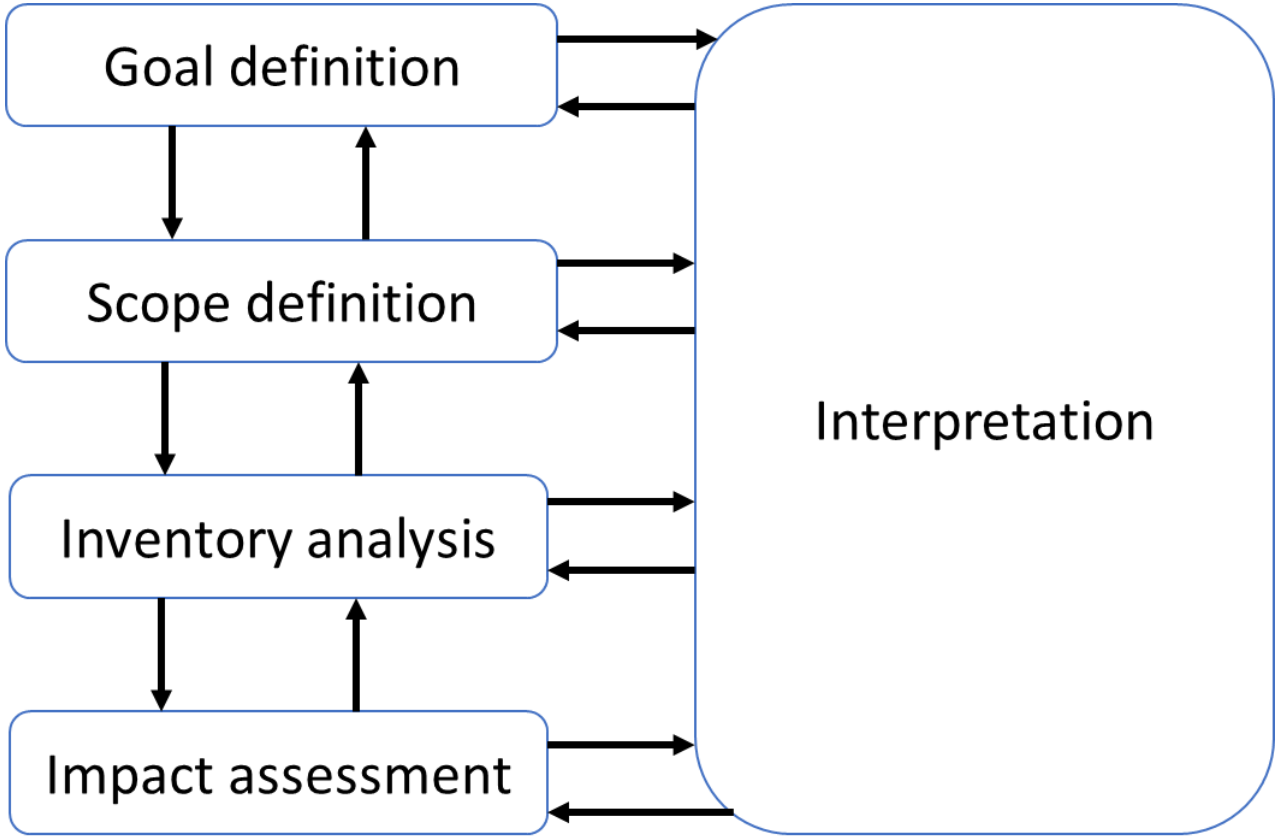
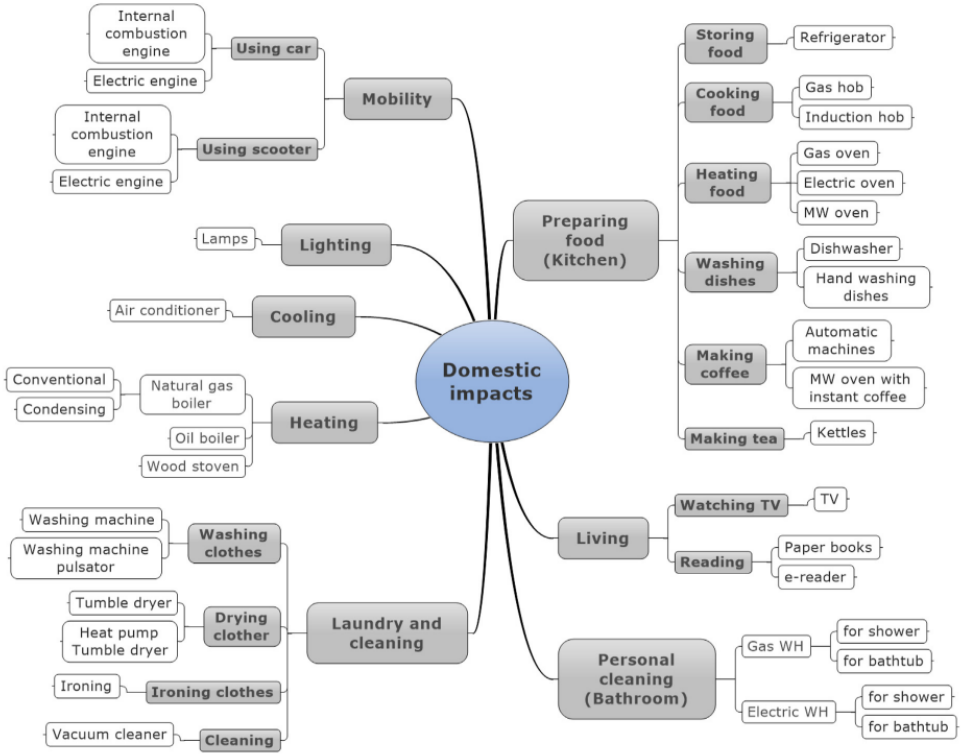
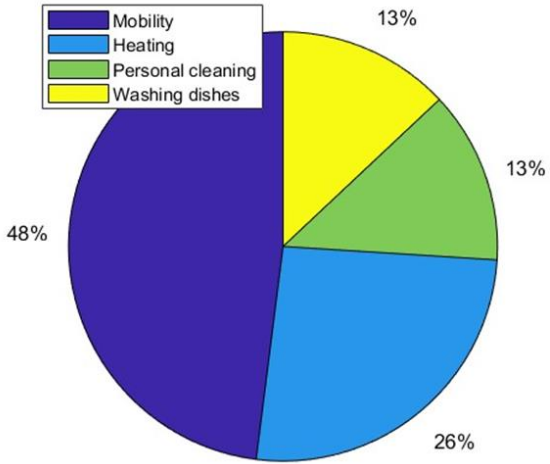
General approach: LCA



Environmental issues of home appliances



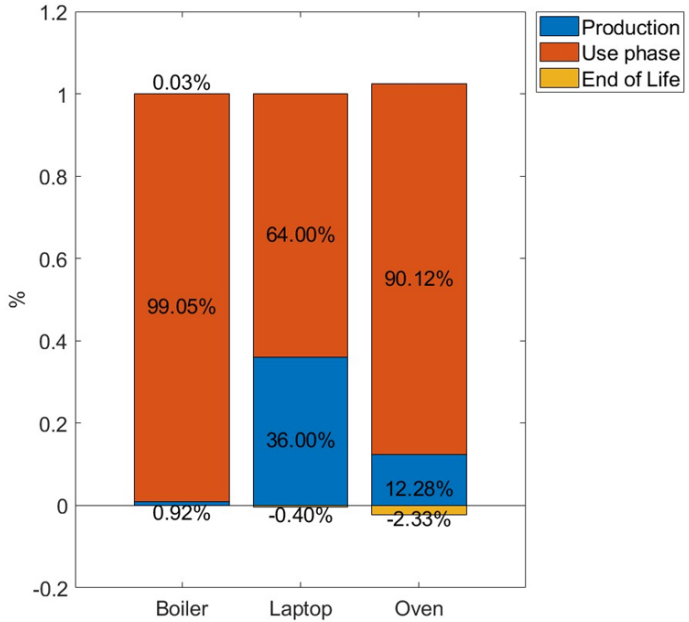
Carbon footprint of an average italian family

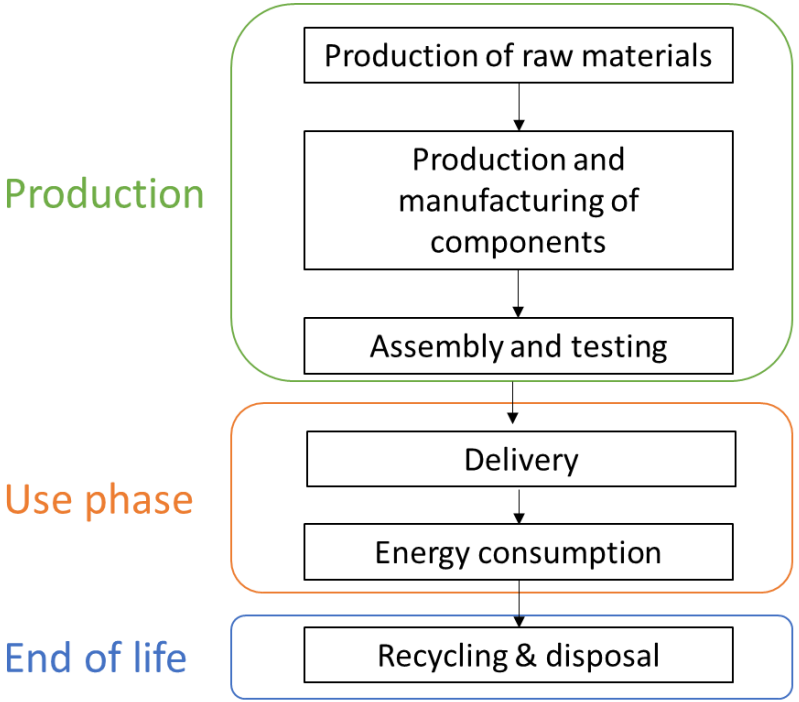


Function	Parameter	Value	Sources
Cooking food	Meals per year per person	200 pasta, 200 tomato sauce, 200 vegetables, 200 omelettes	Favi et al. (2018)
Heating food	Meals per year per person	60 chilled meals, 60 frozen meals, 60 home-made meals	Landi et al. (2019)
Making coffee	Number of cups per year per person	300	Brommer et al. (2011)
	Coffee mass per cup	7 g	Brommer et al. (2011)
	Cup volume	0.125 l	Brommer et al. (2011)
Heating tea	Number of cups per year per person	365	Considering 1 couple per day per person
	Cup volume	0.25 l	Gallego-Schmid et al. (2018b)
Washing dishes	Uses per year per person	280	European Commission (2010)
Watching television	Use per year on-mode	1342 + 7419 (stand-by) hours/year	Austin et al. (2015)
Reading	Number of new books acquired per year per family	18	Moberg et al. (2010)
	Annual use per person of e-reader	182.5 h/year	Moberg et al. (2010)
	Number of e-readers per family	3	Assumption
Personal cleaning	Uses per year per person	300	Piroozfar et al. (2016)
	Time per shower	7 min	Piroozfar et al. (2016)
	Water temperature	37 °C (hot), 15 °C (cold)	Piroozfar et al. (2016)
	Uses per year per person of bathtub (in alternative to shower)	300	Equal to shower
	Bathtub volume	100 l	Assumption
Washing clothes	Uses per year	80.6 (IT), 85.5 (DE), 72.8 (FR)	Average between Schmitz and Stamminger (2014) and Presutto et al. (2007)
Domestic cleaning	Uses per year	0.57 h/m^2 year	European Commission (2013)
Using car	Annual distance	12000 km/year	Gallego-Schmid et al. (2016)
Using scooter	Annual distance	2270 km/year	Lesteven and Leurent (2016)

FU: an average family of 3 people living in a 100 m^2 house

Home appliances carbon footprint breakdown





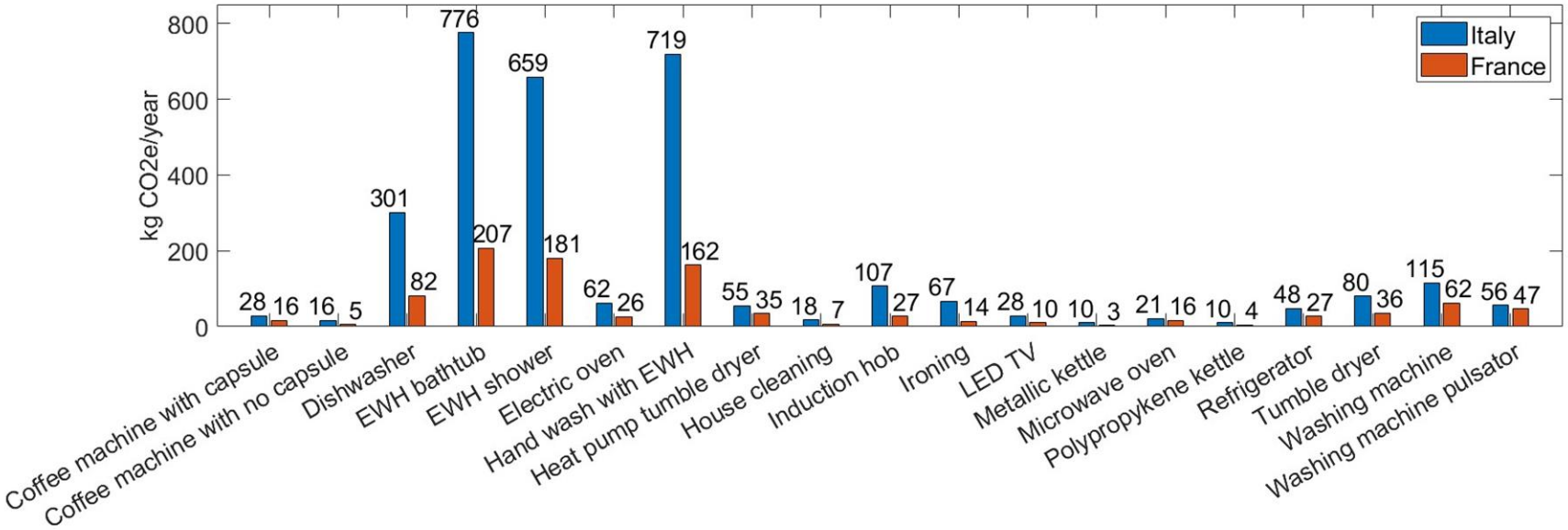
Environmental assessment of domestic boilers: A comparison of condensing and traditional technology using life cycle assessment methodology Giuseppe Vignali

Comparative life cycle assessment of electric and gas ovens in the Italian context: An environmental and technical evaluation Daniele Landi, Andrea Consolini , Michele Germani , Claudio Favi

Life Cycle Assessment of Electronics Otto Andersen John Hille Geoffrey Gilpin Anders S. G. Andrae

Assessing domestic environmental impacts through LCA using data from the scientific literature Christian Spreafico , Davide Russo

The importance of the energy grid mix

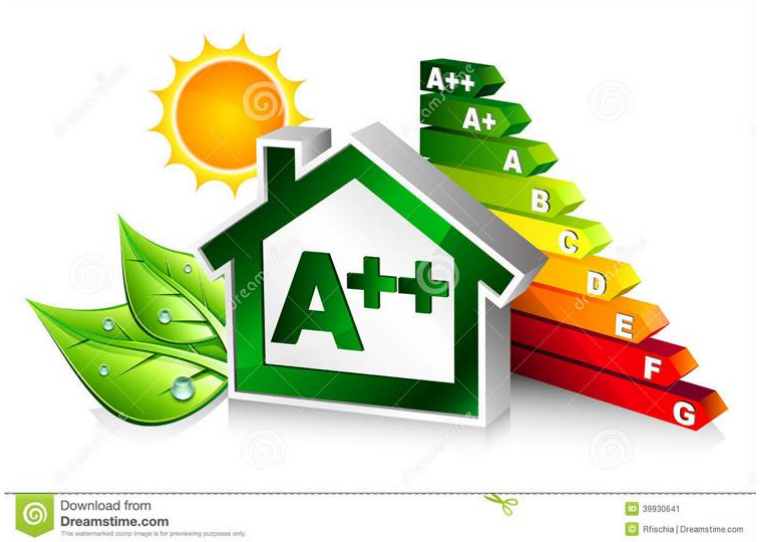


Home appliances: results

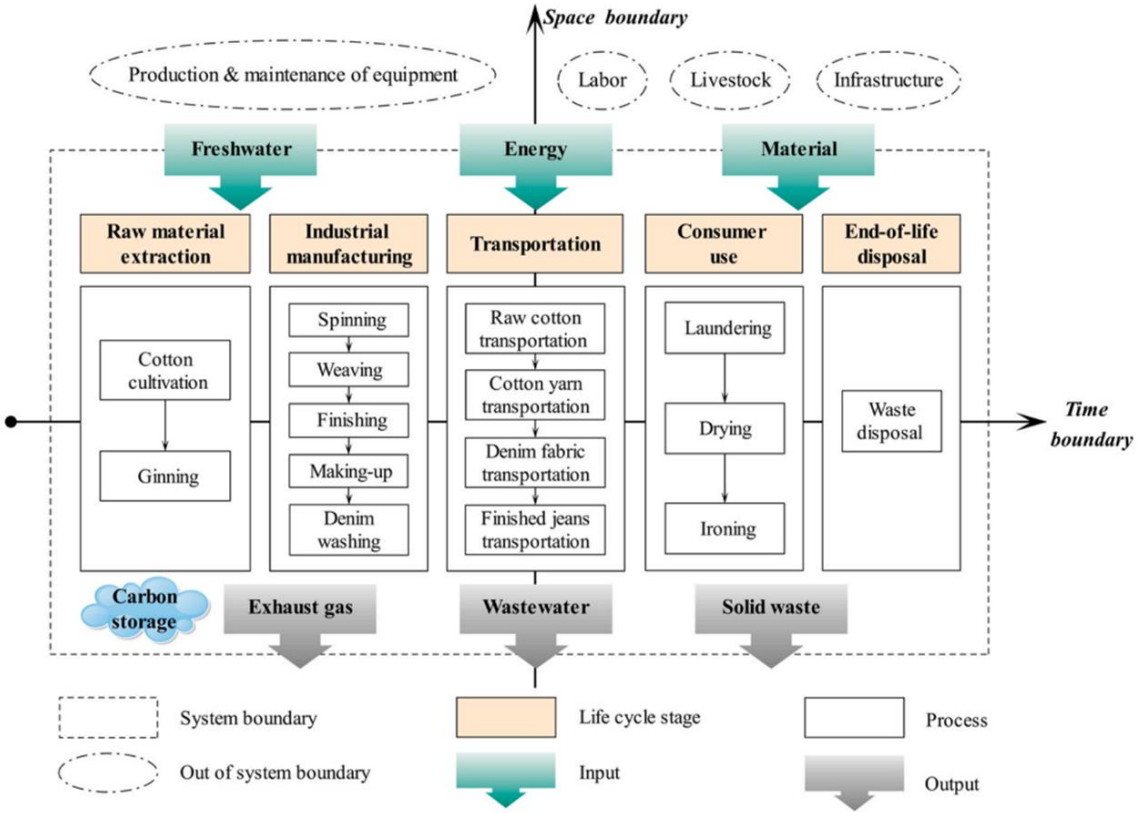
Refrigerator			0,14	kg CO2/day
Food cooking			0,05048	kg CO2/meal
Coffee			0,05953	kg CO2/cup
Oven			0,7091	kg CO2/meal
Washing machine			0,6283	kg CO2/cycle
Shower			0,6057	kg CO2/shower
Heating	North	Insulated	2,995	kg CO2/day
		Not insulated	6,795	kg CO2/day
	Center	Insulated	2,393	kg CO2/day
		Not insulated	5,37	kg CO2/day
	South	Insulated	1,556	kg CO2/day
		Not insulated	2,63	kg CO2/day
Laptop			100	kg CO2/device
Mobile phone			120	kg CO2/device

Environmental tips

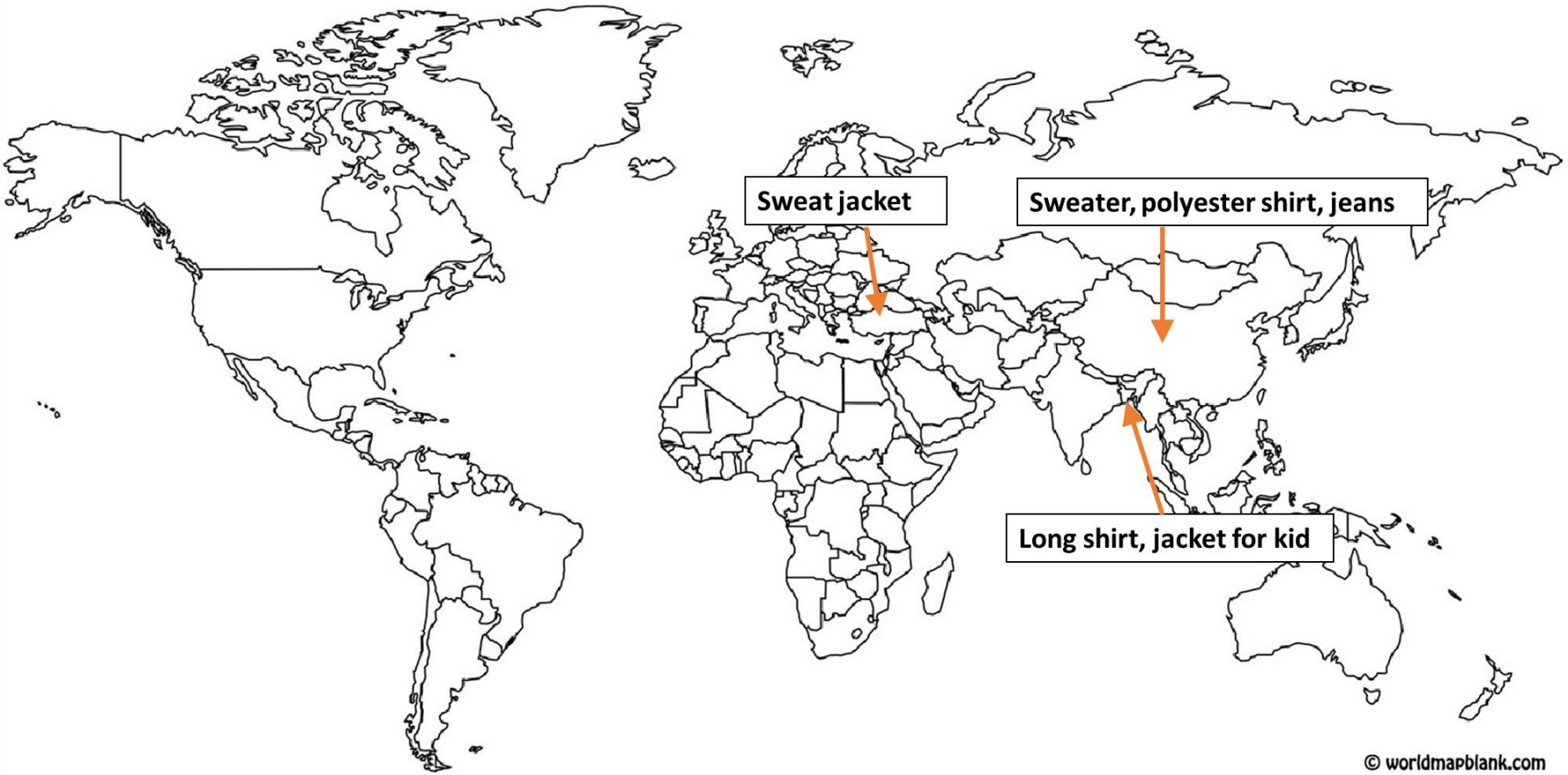
- Use very efficient appliances
- Use smart control
- Increase the share of consumption from renewables



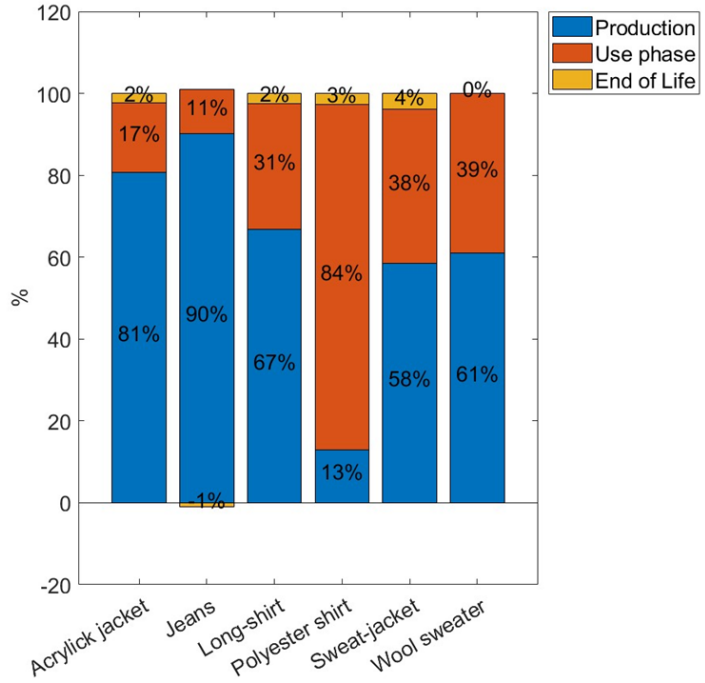
Carbon footprint in textiles

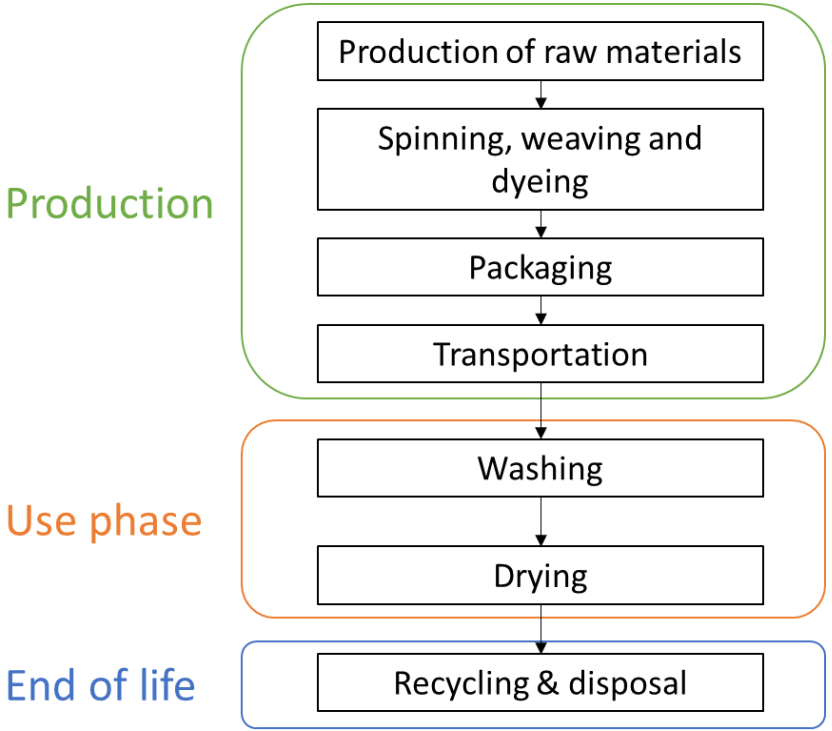


Carbon and water footprints assessment of cotton jeans using the method based on modularity: A full life cycle perspective Yan Luo, Xiongying Wu, Xuemei Ding


Sweat jacket
Sweater, polyester shirt, jeans
Long shirt, jacket for kid
© worldmapblank.com

Textiles carbon footprint breakdown





The carbon footprint of textiles,Norbert Jungmichel, Systain Consulting
Life Cycle Assessment of Four Different Sweaters, Sarah Nolimal, Dr. Christie Klimas
Haode Evaluating the Life-cycle Environmental Impacts of Polyester Sports T-shirts,Wu Zequan
Shanghai American School, Shanghai, 201200, China
Carbon and water footprints assessment of cotton jeans using the method based on modularity: A full life cycle perspective,Yan Luo, Xiongying Wu, Xuemei Ding

Textiles: results

Long shirt (cotton)	10,75	kgCO2/product
Sweat jacket(cotton)	13,42	kgCO2/product
Jacket for kid (acrylic)	13,67	kgCO2/product
Sweater (wool)	13,12	kgCO2/product
Polyester shirt	81,62	kgCO2/product
Jeans	90,37	kgCO2/product

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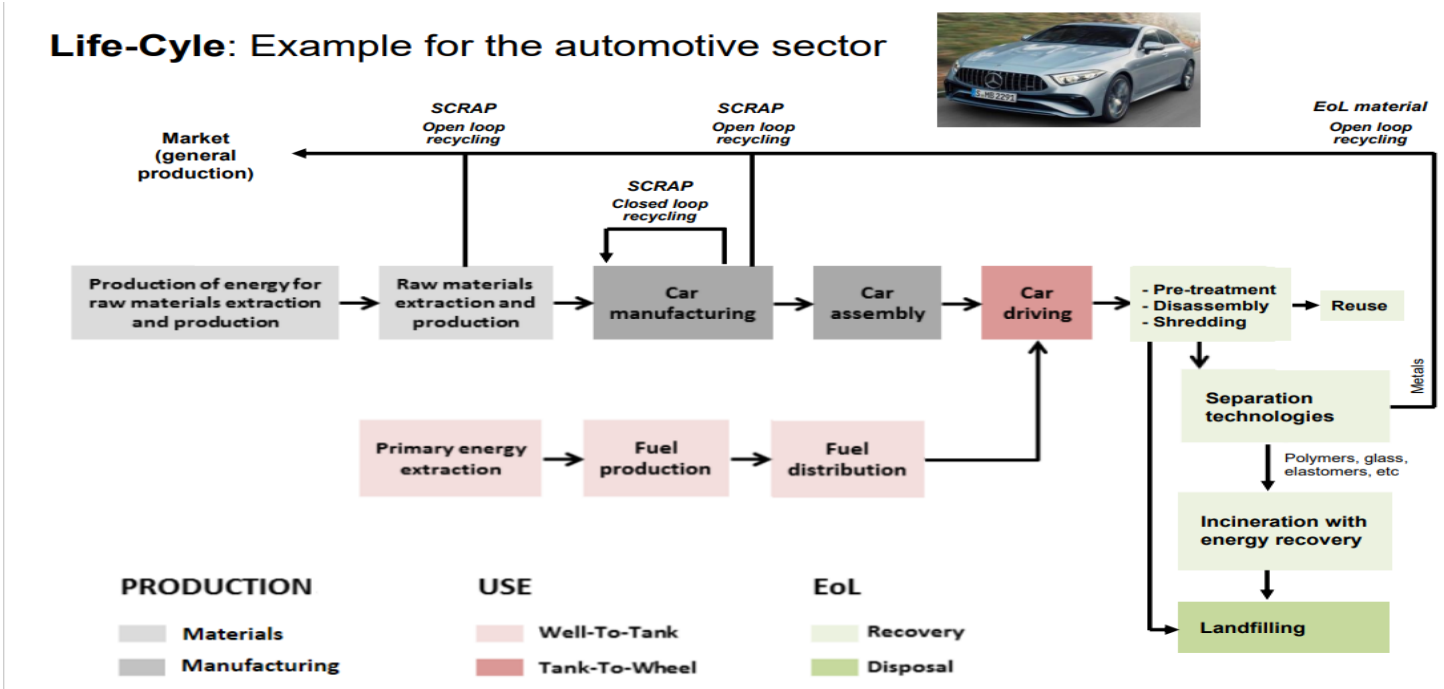
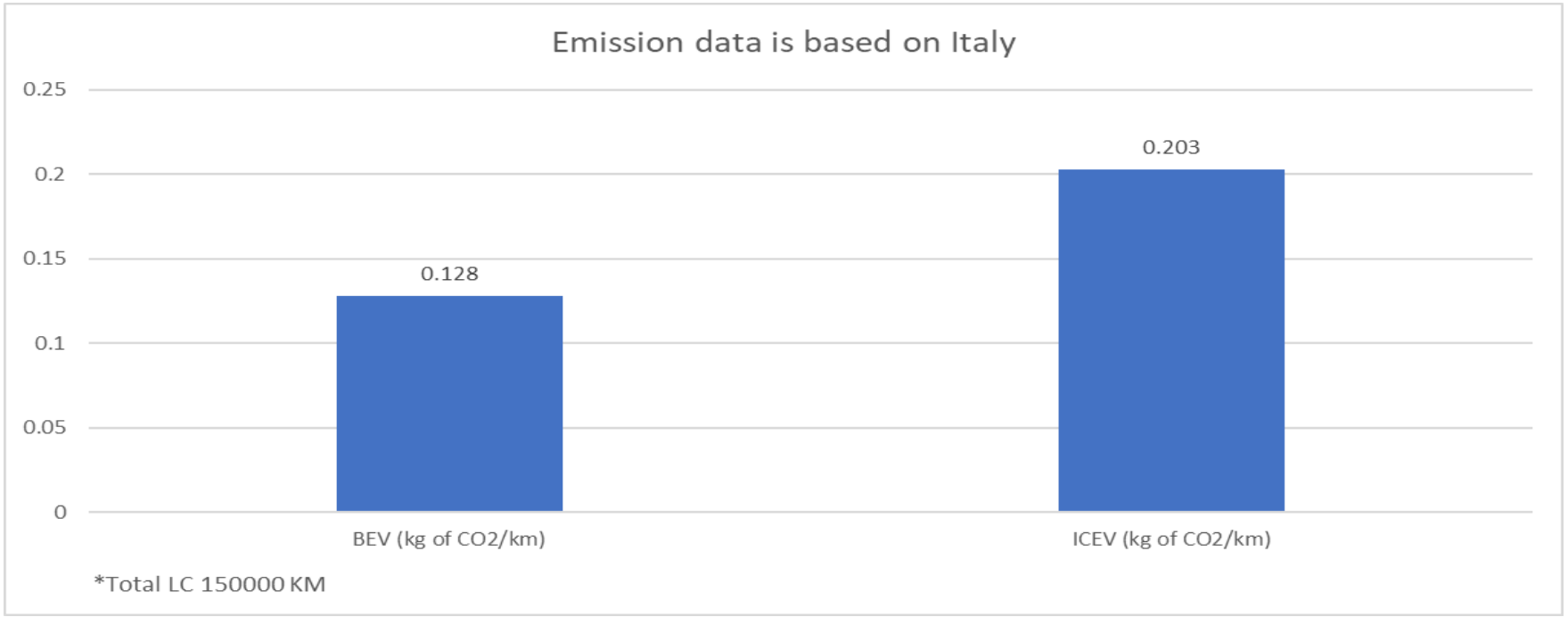
LCA Structure of Automobiles



*System Boundary: Entire LC of the Vehicle

*Source: LCA of Automotive sector, *Author: Francesco Del Pero, M. delogu, Marco, University of Florence, Italy*

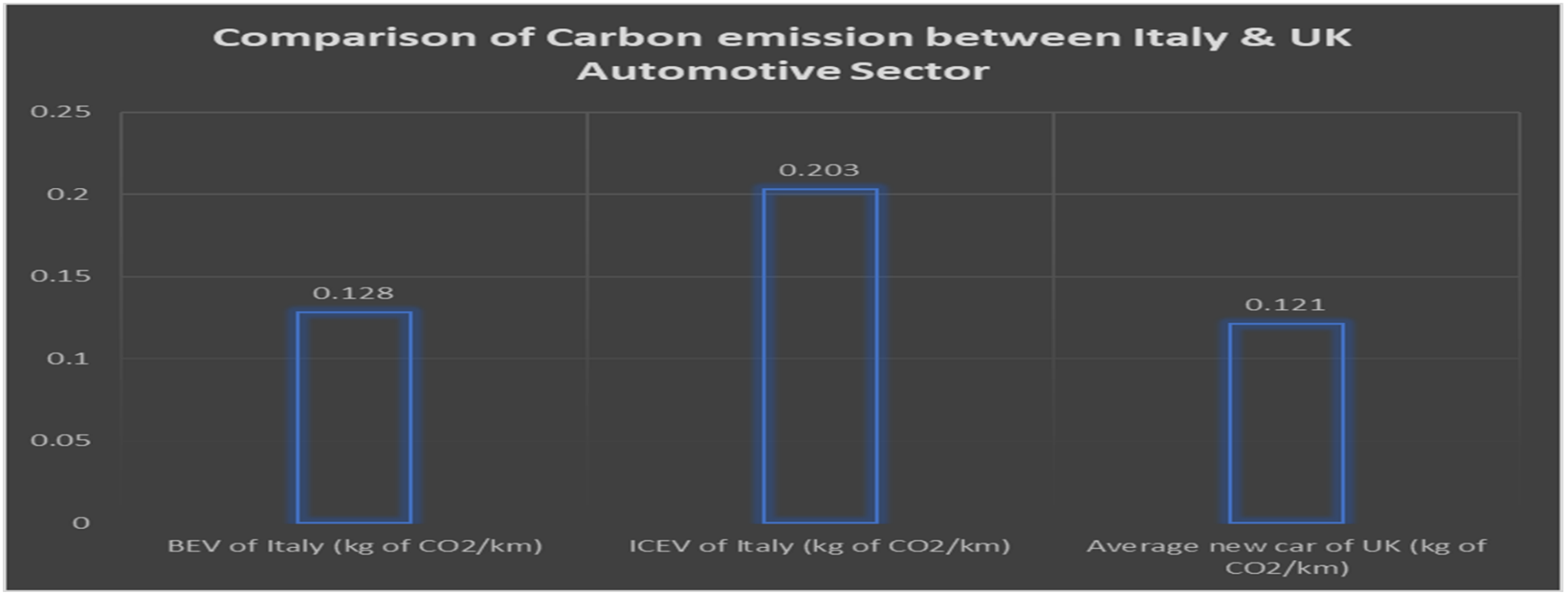
Carbon Footprint of Automobiles



***FU: 150000 KM, *System Boundary: Entire LC of the Vehicle**

*Source: LCA of Automotive sector, *Author: Francesco Del Pero, M. delogu, Marco, University of Florence, Italy*

Italy & UK Comparison

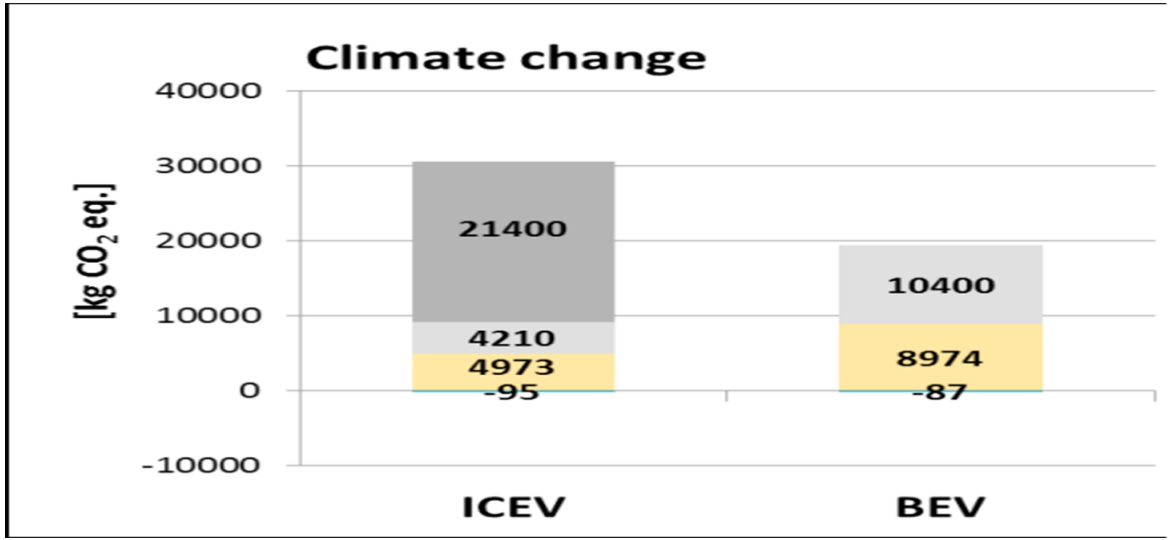


*FU: 150000 KM, *System Boundary: Entire LC of the Vehicle

*Source: LCA of Automotive sector, Unifi, Florence, Italy.

*Source: Automotive sustainability report archive. 2000-2017, Durham University UK, *Author: A. Giampieria, J. Ling-Chinb, Z. Mab*

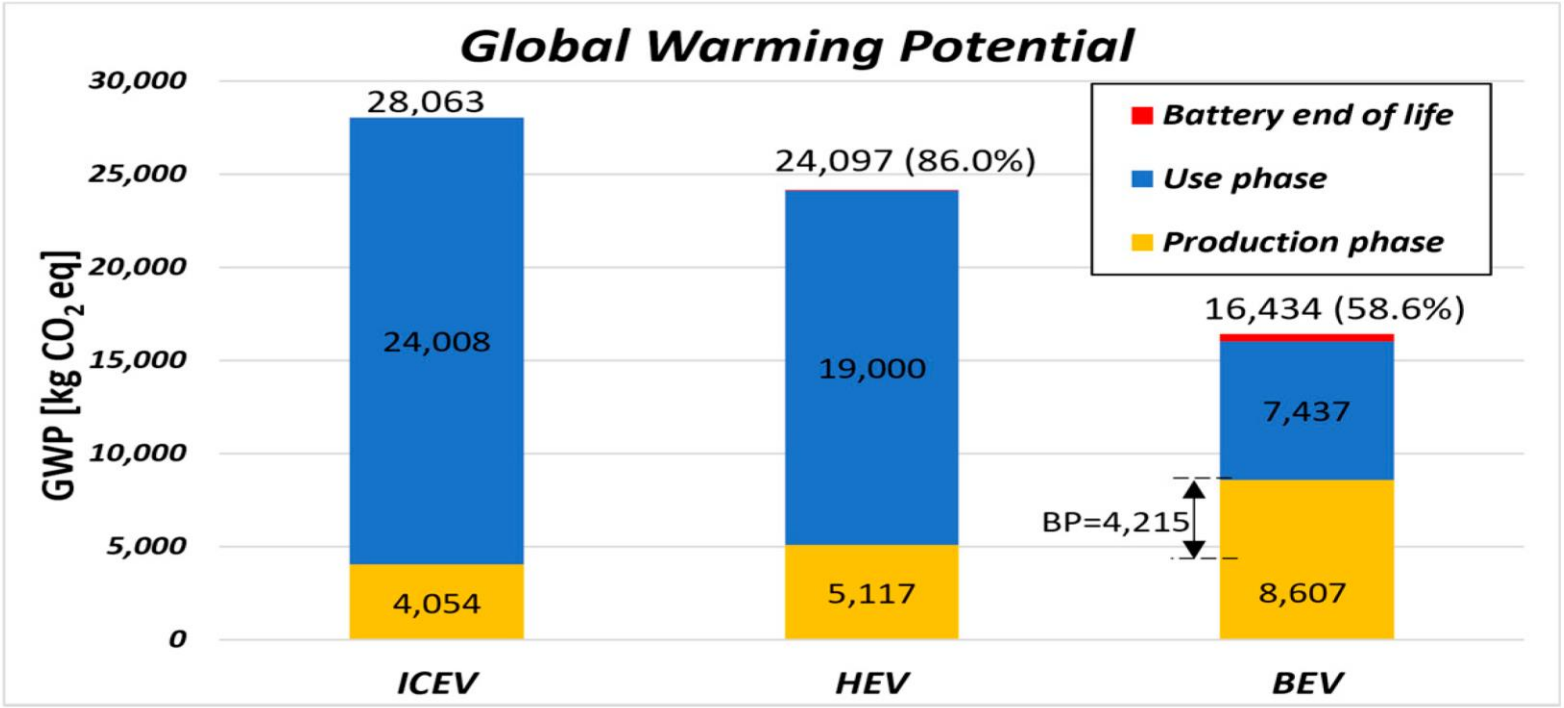
ICEV & BEV Process Comparison



***FU: 150000 KM, *System Boundary: Entire LC of the Vehicle**

*Source: LCA of Automotive sector, *Author: Francesco Del Pero, M. delogu, Marco, University of Florence, Italy*

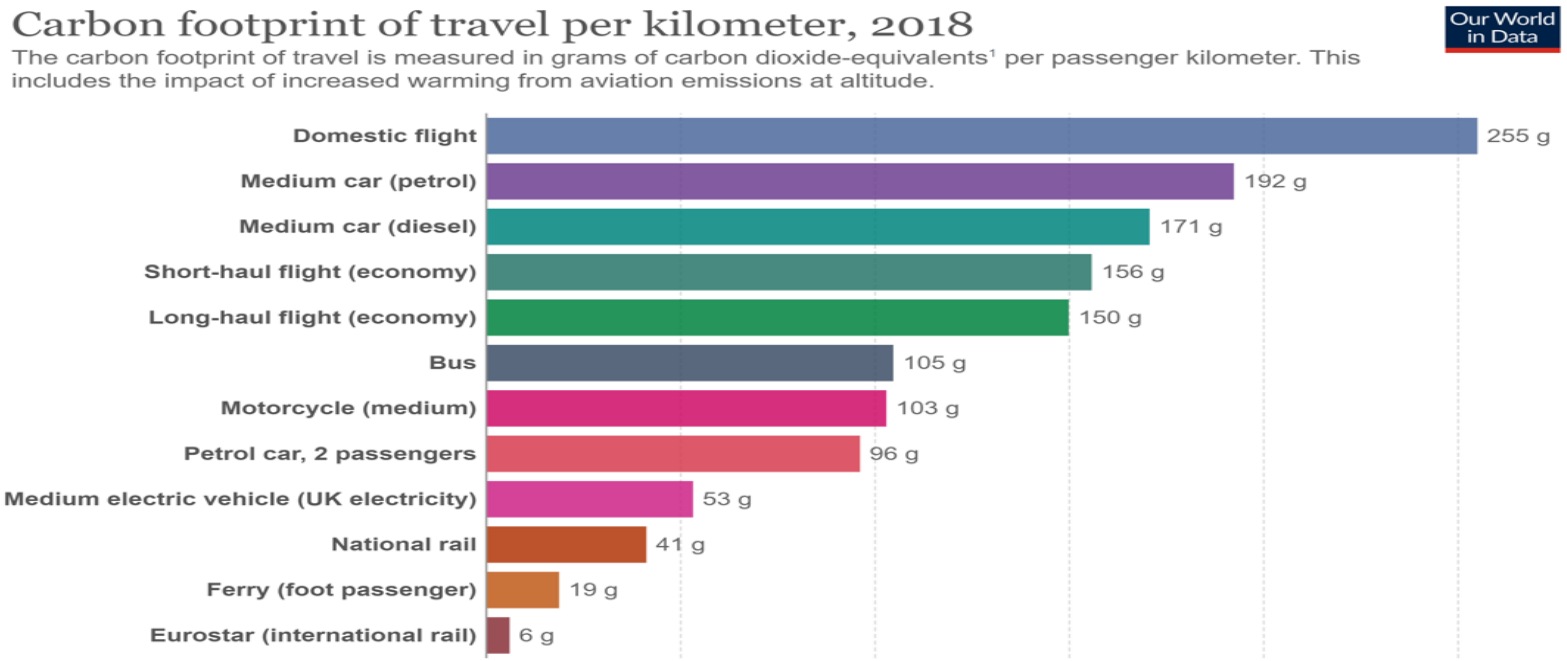
GWP of three Vehicles Mode



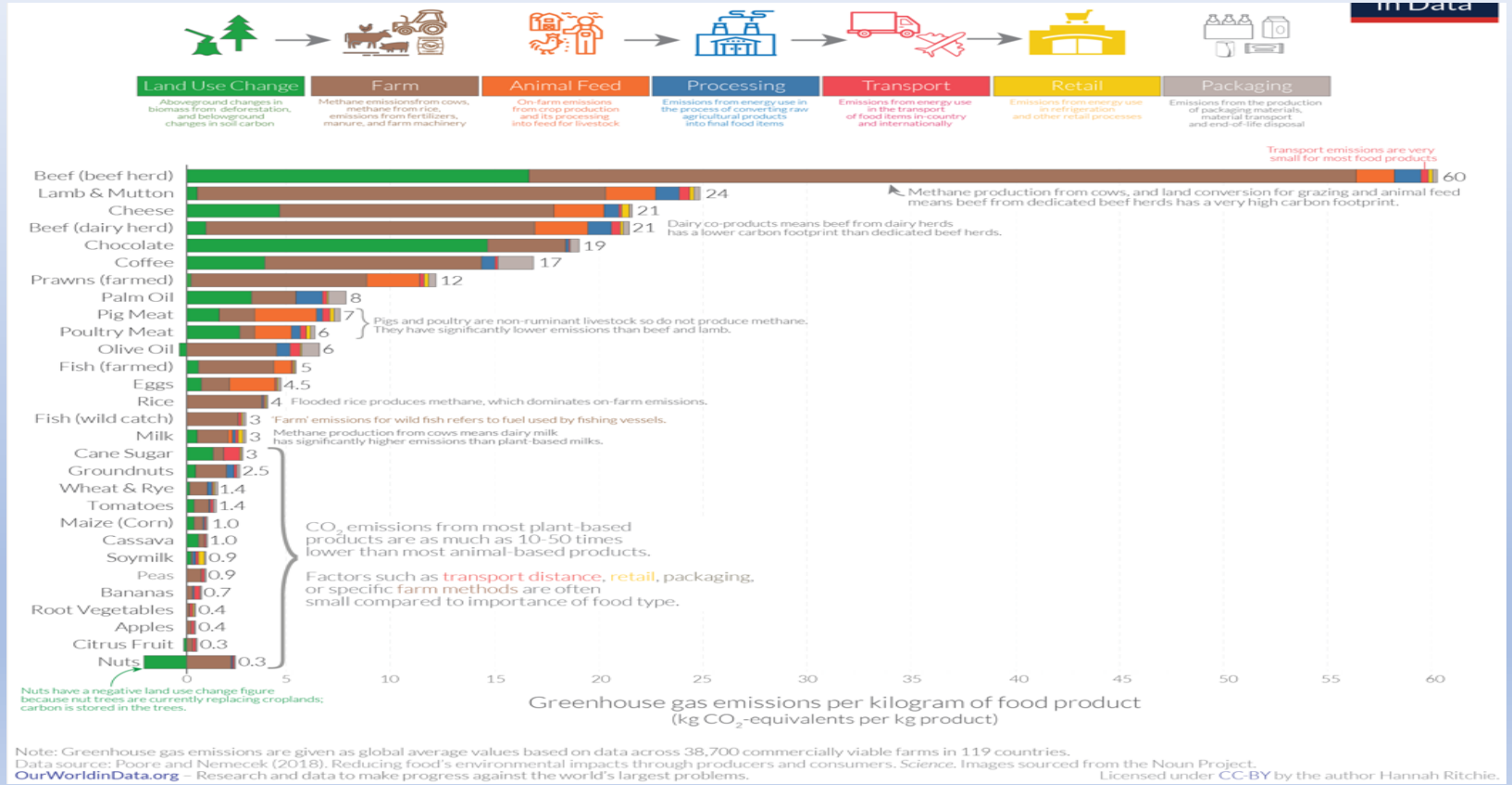
***FU: 150000 KM, *System Boundary: Entire LC of the Vehicle (BoL, MoL, EoL)**

*Source: LCA of environmental impact in European context, *Author: Emiliano Pipitone, Salvatore & Leonardo, University of Palermo, 90128 Palermo, Italy*

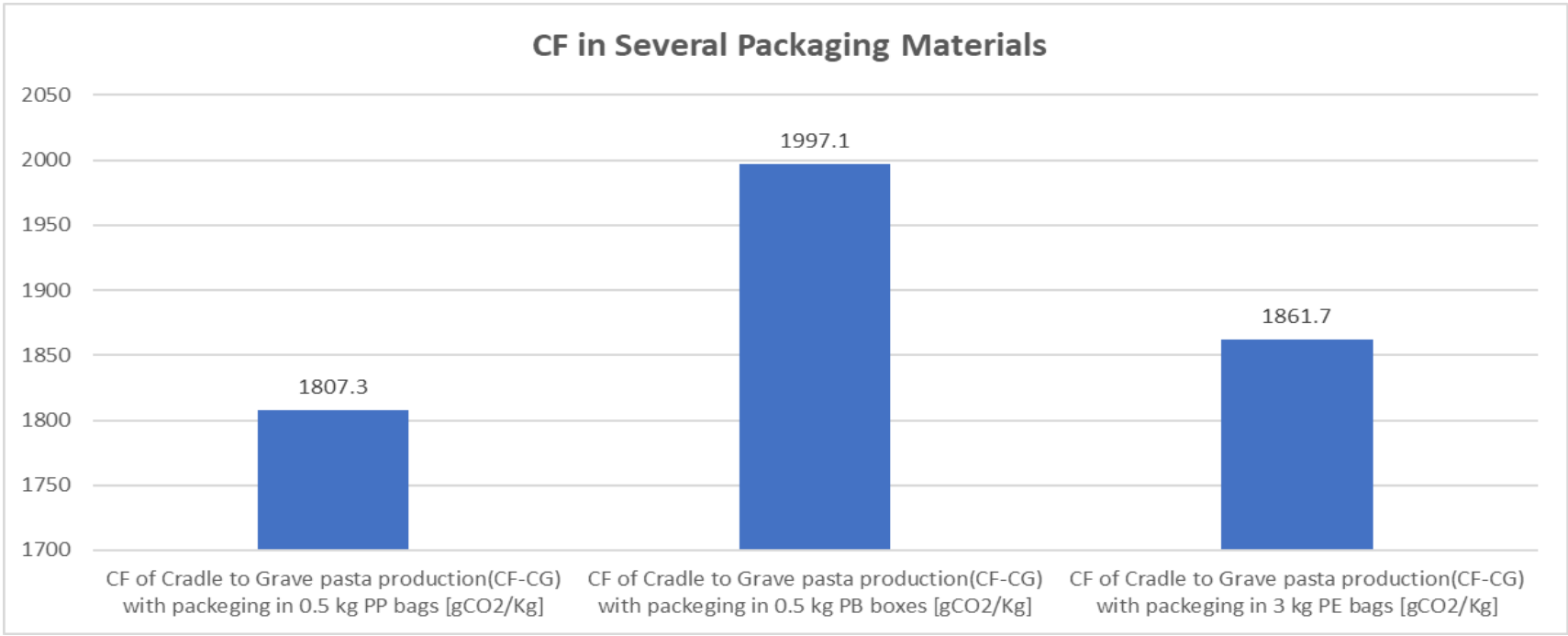
Carbon Footprint Travel Guide



CF Guide on Food via Supply Chain



Pasta CF Variation in Packaging



Source: LCA of Cradle-to-grave carbon footprint of dried organic pasta, *Author: Alessio Cimini, Matteo Cibelli and Mauro Moresi, Supported by the Italian Ministry of Instruction, University and Research.

****LP better than SP, here data SP. 0.5 kg pp bags is more environment friendly than others.***

Impactful Mitigation Strategies

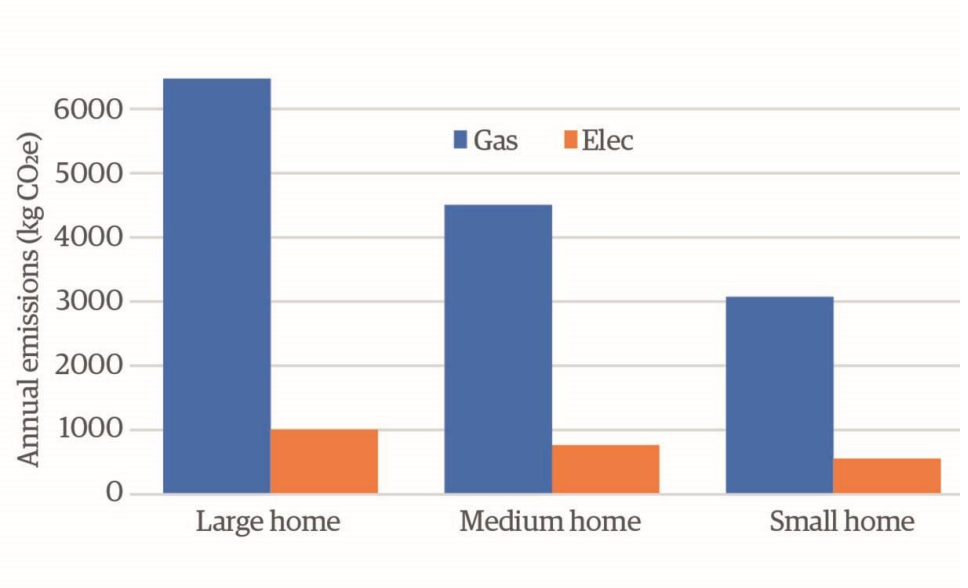
Mitigation strategy	CF_{CG} (kg CO_{2e} kg^{-1})
Reference case	1.807
Eco-sustainable cooking procedure	1.283
Organic rotation cropping system	1.056
Thermal energy from biogas	0.923
Photovoltaic electric energy	0.767
Pasta rail transport	0.731
Pasta shipping transport	0.720
Regional distribution of pasta	0.695
Local supply of durum wheat	0.675

***Effect of the sequential mitigation strategies used to minimize the cradle-to-grave carbon footprint (CFCG), as referred to the production of 1 kg of dry organic pasta packed in 0.5 kg PP bags in the large-sized pasta factory accounted for. The sequential stepwise procedure started from the most impactful parameter.**

Source: LCA of Cradle-to-grave carbon footprint of dried organic pasta, *Author: Alessio Cimini, Matteo Cibelli and Mauro Moresi, Supported by the Italian Ministry of Instruction, University and Research.

Cooking Modes of Pasta

- ***Electric cooking is more environment friendly.***
- ***No Smoke.***
- ***Less emission.***



***Source: RENEW (Technology for sustainable future magazine), Author: Rory Anderson**

Conclusions and Future Developments

Data issues

- Only secondary data were collected
- Data came from different countries and world regions
- The FU was not well defined in every study

Future development

- Direct involvement of manufacturers
- Using the app to make customized environmental tips
- Make the app more user friendly

Developed Web Link

http://pietrogradu.pythonanywhere.com/home