



CARBON FOOTPRINT OF AN EXPERIMENTAL ANIMAL FACILITY

Abdelmalek ZIADI, Camille MENARD, Romuald COUTOT, Jean-Philippe MOCHO, Alexandre FRAICHARD

I. Introduction

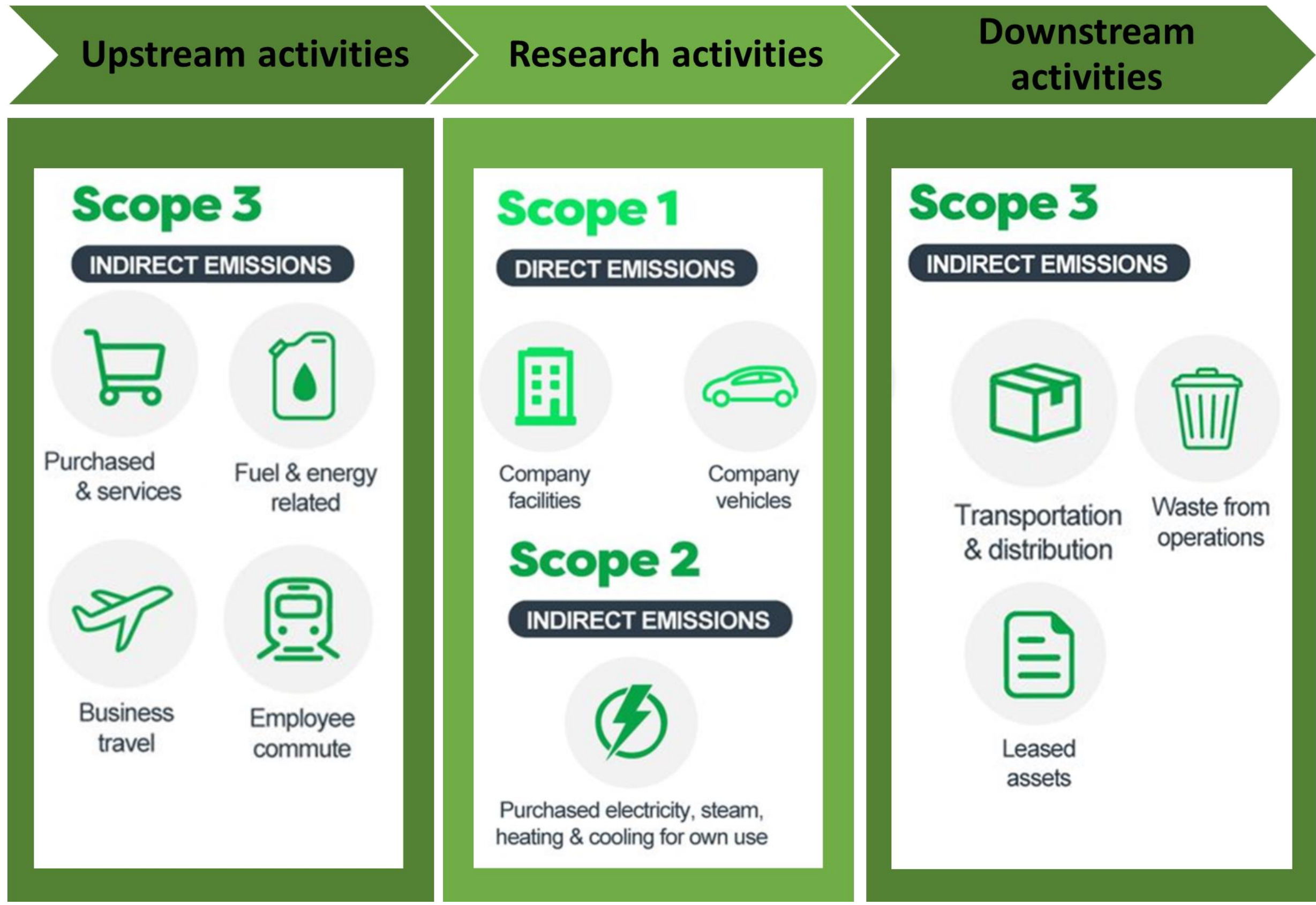
Since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas. We are at a defining moment today.

Burning fossil fuels generates greenhouse gas (GHG) emissions that act like a blanket wrapped around Earth, trapping the sun's heat and raising temperatures. To compare these emissions, we convert them in carbon footprint, measured in kilograms of carbon dioxide equivalent (eCO2) to the global warming potential of a unit of carbon dioxide.

For each activity, the carbon footprint is calculated for a whole year. The results highlight the activity responsible for the highest GHG emissions.

II. Methodology

The methodology used is the GHG Protocol defined in 1997 by the UN in Kyoto, with three scopes of emissions:



Scope 1 : This covers the GHG emissions that an organization makes directly, running its boilers and vehicles for example.

Scope 2 :These are the emissions made indirectly, essentially the electricity that we buy from the grid.

Scope 3 : This includes emissions associated, not with the laboratory itself, but that the laboratory is indirectly responsible for (e.g. supply chain (suppliers), downstream GHG emissions, business travels, waste disposal transportation...).

III. The animal facility

During the AFSTAL workshop in June 2024, we discussed the carbon footprint of an experimental animal facility and chose as example the "Mouse Animal Research Unit":

- gross area usable : 1800 m²;
- a staff : 100 people, including 30 researchers;
- a budget of 3 000 K€ including investments.

IV. Data collection

Upstream activities	Research activities	Downstream activities
Scope 3	Scope 1	Scope 3
Purchase : 656,706 k€	Energy for production : 79 818 kW	Waste : 29,06 k€
Transportation : 11,12 k€	Refrigerant R404a : 2,7 Kg	
Upstream energy : 48,52 k€	Scope 2	
Employee Commute : 879 500 Km	Electricity : 1 351 682 kWh	
Business travel : 86 600 Km	District heating : 811 600 kWh	
Accounting fixed asset : 13,13 k€	Cold production : 313 605 kWh	

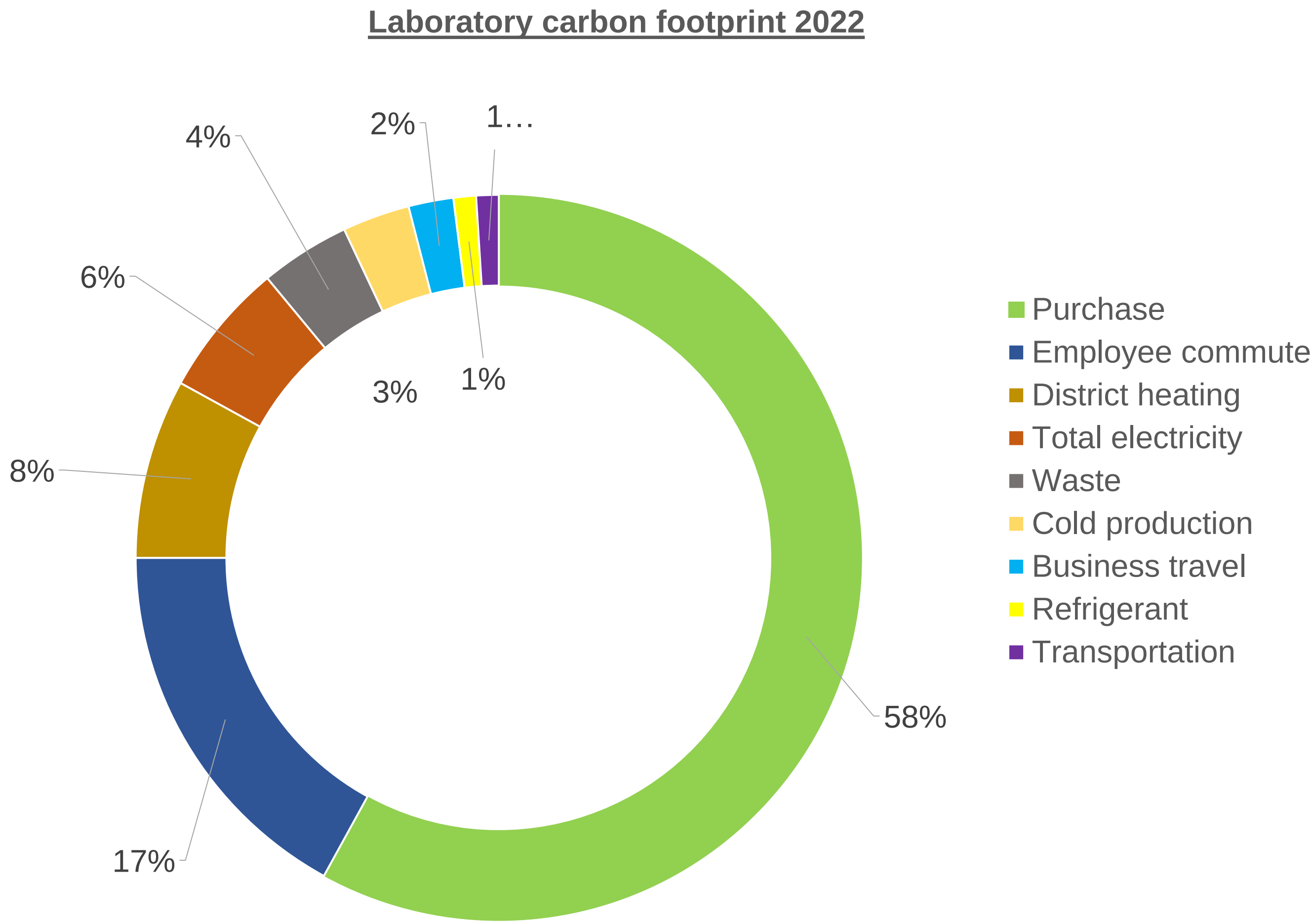
V. Converting data in eCO2

GHG emissions are translated in eCO2 with conversion factors from the national database <https://base-empreinte.ademe.fr/> and the help of an online app <https://apps.labos1point5.org/ges-1point5> (An open-source tool to assess the carbon footprint of research. Jérôme Mariette et al. 2022 Environ. Res.: Infrastruct. Sustain. 2 0350080 <https://iopscience.iop.org/article/10.1088/2634-4505/ac84a4>).

Mainland France	Laboratory	Greenhouse gas emission factor	uncertainties
Accounting fixed asset	1 m ²	825 Kg eCO2	± 50 %
Electricity	1 kWh	0,052 kg eCO2	± 10 %
District heating	1 kW	0,108 Kg eCO2	± 30 %
Cold production	1 MJ	0,084 Kg eCO2	± 30 %
Refrigerant R404a	1 Kg	3943 Kg eCO2	± 30 %
Petrol car	1 Km	0,22 Kg eCO2	± 60 %
Diesel car	1 Km	0,21 Kg eCO2	± 60 %
Electric car	1 Km	0,10 Kg eCO2	± 70 %
Purchase	1 K€	917 Kg eCO2	± 50 %
Waste	1 Kg	918 Kg eCO2	± 50 %

VI. Activities' emissions

Laboratory carbon footprint	Carbon footprint by agent	Carbon intensity (per € spent)
1 552,48 ± 743,33 T eCO2	15,524 ± 7,43 T eCO2	517,493 ± 2,47 Kg eCO2



Regarding purchases, the carbon footprint of a product or service is estimated with an uncertainty of +/-50%. Results are more accurate when suppliers can provide the carbon footprint of their supplies.

Commuting can have a significant carbon footprint depending on the location of the facility.

Heating is the third GHG emitting activity. It involves the facility ventilation, as well as autoclaving.

VII. Actions to reduce emissions

Moving towards responsible purchasing :

- Reduce purchasing volumes by reducing waste and unnecessary purchases
- Select suppliers based on environmental criteria (GHG emissions, eco-design, sustainability, etc.)
- Integrate maintenance, operating and end-of-life costs of equipment into selection criteria
- Favor local suppliers
- Reduce delivery frequency
- Purchase refurbished products
- ...

Heating non-animal facilities :

- For occupied premises, set thermostats to 19°C
- For storage and other unoccupied premises, tolerate wide temperature variation according to season (from 8°C to 25°C)

Air Conditioning :

- Reduce the air renewal rate to 10 volumes per hour
- If it's possible, reduce the volume of animal housing premises

Energy :

- Reduce the electricity consumption of freezers by increasing the temperature from -80°C to -70°C
- Change the lighting to LED
- Install presence detectors in suitable rooms
- Consider the energy efficiency of new equipment
- Space cage changes
- Only operate washers and autoclaves when full

Staff commitment :

- Promote soft mobility (bicycle, public transport, carpooling, etc.)
- Raise awareness among staff regarding climate change
- Communicate internally on carbon footprint and actions to reduce it
- Create working groups (energy, waste, mobility, purchase, etc.)

Promoting the 3Rs in waste

- Reduce
- Reuse
- Recycle

VIII. Conclusion

Faced with the global challenge of climate change, it is necessary to commit to a process of reducing GHG. It is a collective approach which requires mobilizing all laboratory agents in favour of the environmental transition.

Carrying out a carbon footprint assessment offers many advantages as :

- environmental benefits such as the contribution to national and international objectives in terms of carbon impact reduction or the preservation of natural resources;
- economic benefits such as cost reduction opportunities;
- strategic benefits such as improving the laboratory's image, strengthening attractiveness, and developing a committed corporate culture.

