FOR19

Green Digitalization and App Development

Methodology paper

Candidates: 2, 4, 10, 16, 17, 24

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1. Introduction

Motorised transportation, whether on land, sea, or air, heavily relies on internal combustion engines fuelled by fossil fuels. This sector contributes over a third of CO2 emissions from end-use activities. To align transportation with the International Energy Agency's Net Zero Scenario, a comprehensive range of policies must be implemented. These policies aim to promote transitions towards travel options with lower carbon footprints and to introduce operational and technical measures enhancing energy efficiency across all modes of transport. In line with the Net Zero Scenario, emissions from the transport sector must decrease by approximately a quarter by 2030, despite the continued growth in transport demand. This necessitates policies encouraging the adoption of less carbon-intensive travel alternatives such as walking, cycling, and public transportation, alongside the adoption of more efficient technologies like electric vehicles for cars and trucks (International Energy Agency, 2023).

However, the reason why we consider the development of an application like this to be important is to combat social inequalities in the face of the ecological transition. In fact, companies and politicians, by being more solicitous, could become more aware of this issue. Indeed, there are significant inequalities in ecological responsibility :

Our application is part of a worldwide drive to reduce our carbon footprint. Calculating our carbon footprint appeared at the same time as calculating our ecological footprint, as a component of the latter. However, it gained great popularity in 2003 with the advertising campaign of the oil and gas company BP. In this campaign, individuals were asked about their carbon consumption and encouraged to pay attention to it using the company's calculator. The campaign illustrates the particular ecological responsibility placed on the general public, with corporate responsibility taking a back seat. Given the difficulty of finding research on this subject on a global scale, we can use France as an example to illustrate the problem. The Bilan environmental of the France Édition 2022 published in 2023 by the Ministère de la Transition écologique et de la Cohésion des territoires indicates that businesses finance 33% (or €17bn) of environmental protection expenditure, and households 28% (€14.2bn). To the latter, we must add the financing of public administrations, which is 38% (i.e. 19.6 Md€). Indeed, as the article points out, taxpayers are the main financiers of public administrations. In total, the public finances almost 66% of environmental protection expenditure in France (appendix graph 1)

On the other hand, there are also significant inequality in carbon emissions:

The amount of carbon is not the same everywhere and for everyone. Indeed, as the World Inequality Lab's 2022 report shows, there is a significant difference in emissions between different countries, but also according to income, both on a global scale and within countries. First of all, we can observe that almost 50% of the world's carbon emissions in 2019 were emitted by the top 10% of income earners, while the bottom 50% produce just 12%. On average, a person in the top 1% will emit more than 68 times as much as a person in the bottom 50% of the population (graph 2 and 3). Although inequalities in emissions between the world's regions have diminished overall, inequalities persist and are all the more significant when we look at the distribution within the population. Even within underdeveloped or developing regions, we find large emitters (graph 4 and 5). For example, in East Asia, the richest 10% of the population emit an average of 38.9 tonnes of carbon per year, compared with 3.1 tonnes for the lowest 50%. And this difference is even more apparent when compared with the USA, where the poorest 50% emit an average of 9.7 tonnes per year, and those with the highest incomes emit an average of 73 tonnes per year. What's more, the world's poorest population is already at (or close to) the emissions levels required to meet the Paris Agreement 2030 target, whereas the highest social class is not (graph 6 and 7).

In the 2019 Organisation for Economic Co-operation and Development (OECD) report "Owners of the World's Listed Companies", it is explained that the top three shareholders control more than 50% of the capital in half of the world's companies, and more than 30% in three-quarters of them. Thus, in addition to a relatively widespread consensus in the literature on this issue, we can assume a close link between companies and people from the upper social class. Yet, as we have seen, despite a highly unequal carbon footprint between the different social classes of the world's population, the bourgeois class is not called upon to the same degree as the other classes for the ecological transition. While up to now measures such as carbon taxes have often had a disproportionate impact on modest- and middle-income households, without significantly influencing the consumption habits of the more affluent segments of society, the scale of these inequalities points to the need to redirect climate policies towards a more precise target: wealthy polluters.

As such, our application is set against a backdrop of political, economic, social and geopolitical issues.

In view of all that, this essay will attempt to explain and analyse our approach to creating this application. First, we'll explain our methodology. This will include data collection, the application of emission factors and the creation of a carbon calculator. Our research has enabled us to identify potential policy ramifications. In the second part, we will explain our business model. Our business model focuses on the diminishing environmental impact of corporate travel. Indeed, as we saw in the first part of the introduction, businesses hold a pivotal role in curtailing carbon emissions. Our innovative, user-friendly app serves as a vital tool for companies aiming to showcase their commitment to environmental stewardship. By furnishing data on travel-related emissions, we empower businesses to grasp the extent of their carbon footprint and adopt strategies to effectively mitigate it. In addition, as we move forward with the development of our application, we intend to introduce supplementary features to bolster its functionality and assist businesses in further reducing their emissions.

2. Methodology

2.1 Calculating and comparing carbon emissions

To calculate the impact of every transportation over the environment, we will use a tool called Global Warming Potential (GWP). This tool calculates how a greenhouse gas can potentially contribute to global warming through the greenhouse effect. It uses CO2 equivalents as a reference.

For example, 1 kg of methane released in the atmosphere is equally harmful as 25 kg of CO2 (if we consider a period of 100 years because some gases can be more or less harmful in a longer term). These figures have been calculated by the IPCC (Intergovernmental Panel on Climate Change). Here is the table released by the IPCC to assess these equivalents : https://archive.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

Each transportation can have different types of fuel, depending on their specific need of energy. Therefore they release different gases in the atmosphere, which have different impacts on the environment. Here is a list of the main gases released by the following transportations during the combustion :

Transport Method	Emission type
Plane	CO2, CH4 NOx
Train	CO2, Nox (depending on type of train)
Car	CO2
Electric car	CO2 (from power consumption)
Ferry	CO2, SO2, NOx, CH4
Bus	CO2, NOx
Motorbike	CO2

2.2 Data foundation

In this section of the paper, we should present the data foundation for our carbon emissions calculator, including the numbers and assumptions used in our calculations.

In the appendix (Table1: Emissions table) we have shared a table with the CO2 equivalent emissions for each transport method that we have found through our research. These numbers are the amount of CO2e the transportation method will emit per kilometre travelled per person.

The data is originating from the from places: researches of Our World in Data (https://ourworldindata.org/grapher/carbon-footprint-travel-mode?tab=table) and the french Agency for the Ecologic Transition (ADEME, https://impactco2.fr/transport). Our figures consider the CO2 emitted during the actual use of the vehicle, but not the production of each one of them or during the delivery to the customer. In addition our model does not take into consideration the emissions produced during the maintenance of the vehicles, for example changing parts. Adding something like this to our app would be difficult to implement and because it would require the user to add more information which they may not possess. In order to keep the app simple, we decided to focus only on the emissions whilst traveling.

We also consider the walk and the use of the bike as carbon free since their impact on the environment is nonexistent or insignificant.To put our carbon emission calculator into practice, we rely on the figures mentioned above to come up with a formula for each transportation. The calculator displays the emissions emitted per passenger during the trip.

The general formula

e : CO2 emissions per km
d : number of kilometres travelled

- Formula for total emissions : (e*d)

Motorbike

We consider the motorbike to transport only the driver. For that reason, the calculation of CO2 emissions for this specific vehicle is merely the product of the emissions per kilometre and the number of kilometres travelled.

Cars formula

e : CO2 emissions per km
d : number of kilometers travelled
w : coefficient regarding the weight of the vehicle (small size, standard size, SUV)
Passengers : the number of passengers present in the vehicle

Cars powered by fossil energy

Formula CO2 total emissions : (e*d*w) = (0,192*d*w)

The given figure of CO2 emissions is here the total consumption of a standard size car (on the contrary to the other vehicles). We chose to give the variable w three possible values. A standard size vehicle is being attributed the value 1. We consider that an SUV, for a same distance, is responsible for 15% more CO2 emissions on average than the standard sized vehicle. The w variable for an SUV will therefore take the value of 1,15. A small sized vehicle, which on average emits 15% less CO2 than a standard sized vehicle is attributed the value of 0,85, according to the same principle.

Electric cars

Formula CO2 total emissions : (e*d)

There are no direct emissions from driving, but indirect emissions from charging if the electricity was generated using fossil energy. As mentioned before we don’t consider the production of the car in the emissions of CO2. (which are the main factor of emissions of an electric car)

Formulas shared transports

e : CO2 emissions per km
d : number of kilometres travelled
Passengers : the number of passengers present in the vehicle

- Formula for total emissions : e*d*Passengers
- Formula for emissions per passenger : e*d

By willing to provide information about the total emissions of CO2 as well as the emissions per passenger, we encountered some difficulties finding the most accurate figures for shared transports. We base our calculations on the average CO2 emissions per kilometre and per passenger, which doesn't allow us to provide precise information about the total amount of CO2 emitted per kilometre, since this one doesn't rely much on the number of passengers present onboard. Therefore, to be as precise as possible for these shared transport, we introduce in our calculator a minimum and a maximum passenger to enter.

Bus, Train, Ferry foot passenger and Plane

- Formula CO2 emissions per passenger : (e*d)
- Formula CO2 total emissions : (e*d)*Passengers

Formula ferry car passenger

e : CO2 emissions per km for one passenger (driver)

e' : CO2 emissions per km for additional passengers

d : number of kilometres travelled

p': number of additional passengers (excluding the driver)

P: total number of passengers'

c: number of cars on the ferry

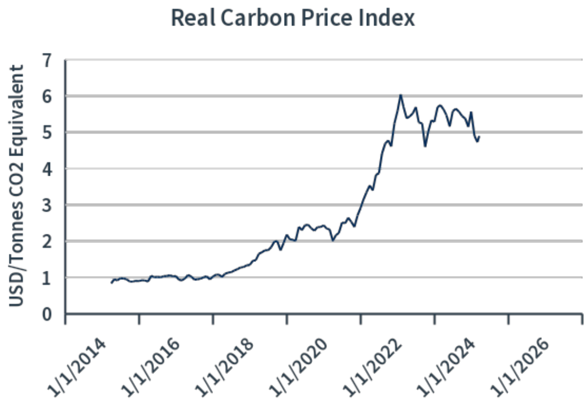
- Formula (for one car) CO2 emissions : (e*d) + (e'*d*p')
- Formula CO2 emissions per passenger : ((e*d) + (e'*d*p')) / P
- Formula CO2 total emissions : ((e*d) + (e'*d*p')) * c

We believe that adding this transportation to our calculator is relevant, especially in Norway, since a lot of car rides in Norway involve taking a ferry with car passengers.

For one single passenger, the formula remains the basic product of the distance travelled and the level of emissions per km (0,129 g/km). Each additional passenger emits, according to Directferries.uk, emits 0,0187 g of CO2 per kilometre. To display CO2 emissions per passenger, we must divide the total CO2 emissions by the number of passengers. Hence the formulas above.

3. Business model

Our app's business model is designed to cover two segment groups, so we will be able to reach private individuals and the corporate sphere, which has an increasing need for sustainable solutions. With a rising awareness among companies regarding the significance of minimising their environmental impact, our app presents a valuable tool to support them in reaching their sustainability objectives.



Source: Bloomberg

The chart illustrates the development of carbon pricing and its anticipated upward trajectory, underscoring a growing inclination for companies to reduce their carbon footprint.

Customer Segments

In order to get first traction for the application we decided to create a Minimum Viable Product (MVP) by implementing the carbon emission calculations for the individuals that can choose their type of transportation which includes bus, train, car, plane, motorcycle, ferry and walk. This will help us to gather valuable data for future partnerships with the businesses and gain trust, due to the fact that companies need to check the functionality of our product on a free basis. However, our primary target group is the shipment companies that want to adjust their carbon footprint, to minimise their impact on the environment and optimise their cost structure. Due to the new regulations which were adopted by the European Parliament in April 2024 for the new heavy-duty vehicles (HDV's), CO2 emissions from large trucks and buses will have to be reduced by 45% for the period 2030-2034. This can help increase demand for our app in the market, since it gives the companies accurate calculations of the carbon emissions of their shipment business. In the long-term perspective, by gathering more data from our existing customers and by collaborating with research institutions, we plan to expand our profile to the maritime shipping industry, since this field has one of the highest impacts on the environment. The International Maritime Industry (IMO) set the new standards and aims to achieve net-zero emissions in the sector by 2050.

Value Propositions

The value proposition includes calculations of the CO2 emissions for the individuals, who are interested in reducing their carbon footprint and willing to explore their impact on the environment. Also, as it is written in the above in Customer Segments paragraph, our main focus is on the calculations of the Scope 1 emissions, which includes emissions produced by the controlled or owned resources of the companies and includes emission from the companies vehicles and trucks. Also, we want to create blog posts on the website, where we will share the recent news and regulations in the shipment industry, as well as creating a community of our users by incorporating a user blog, so we are able to gain more activity from the clients and increase brand loyalty.

Channels

The main channel of the customer interactions is the website, where our tools are provided. In order to get more activity and a sense of community, our long-term plan will be to incorporate the user blog on the website, where customers can discuss relevant topics in the field of sustainability with other users. With the help of social media, such as Linkedin and Facebook, we can promote our offer to the targeted audience, share the updates, post cases of the work with our clients and write about the relevant news in the sector. Lastly, by visiting formal events and participation in conferences, where we can participate as speakers and put on display the stand with our offer, we will get broader access to the target audience and find potential partners.

Revenue Streams

Our application includes the possibility to calculate CO2 emissions produced by individuals by using various means of transportation, which we will offer on a free basis. Nevertheless, until the broader expansion of our application, we will have two streams of revenue: corporate clients to whom we offer complex calculations of their carbon footprint within the Scope 1 emissions and advertisement that will be posted on the website that includes partnerships with sustainable brands that want to promote their services. For the complex calculations of Scope 1 emissions we will offer paid subscriptions to customised solutions and paid API services for those who want to integrate our calculator in their own digital platforms.

Key Activities

Application development and maintenance; creation of content on social media to interact with users and promote our services; data analysis and partnership agreements.

Key Resources

Partnerships; team that consists of UI/UX designer, back-end developers, marketers, content creators and researchers; intellectual property; financial resources and technology infrastructure such as databases and software.

Key Partnership

NGOs and government organisations: by cooperating with research institutions and environmental agencies, we are able to receive insights on such topics as climate change, environmental sustainability and environmental conservation, as well as provide access to green activists, policymakers and researchers, and gain official recognition among experts along with a confident presence on the market. Additionally, we are eager to partner with the international Maritime Organization (IMO). This, given their acceleration of zero-emission targets to 2050 underscores the urgency for carbon neutrality in the industry (DNV, 2024). These developments not only address the initial steps towards addressing environmental concerns in the shipping industry but also position our carbon app perfectly to support companies navigating this transition.

Customer Relationships

Our main task will be continuously collecting feedback from the clients, engaging with the users on social media to constantly address the value proposition of the application. We will also focus on providing excellent customer support to address any inquiries, feedback, or issues users may have regarding the application or their carbon emissions calculations and work on the tailored solutions to ensure the best possible experience for our customers.

4. Summary

Motorised transport, either on land, in the sea or in the air contribute a significant amount of CO2 emissions each year. The sheer volume of transports using fossil fuels necessitates new policies from governments all over the world.

In analysing the social implications of ecology, we have seen that there is a significant difference between the amount of carbon emissions by the upper class and the rest of the population. However, policies mainly commandeer the middle and working classes to finance the ecological transition, imputing most of the ecological responsibility to them.

To help both individuals and businesses analyse and reduce their carbon footprint, our team has designed an app that calculates their carbon footprint using a detailed methodology based on GWP (Global Warming Potential). GWP compares all the other Greenhouse gases to CO2, which creates a common measure called CO2-equivalents. An example of this is the relation between Methane (CH_4) and CO_2. In the atmosphere 1 kg of Methane gas has the same GWP as 25kgs of CO_2.

Our business model has a long-term goal of complex B2B services, the application will cater more and more towards businesses with more complex operations and a need for an efficient cost structure. To cultivate a large and active customer base our team will implement a blog on the website where users can discuss topics related to sustainability in transport and in life.

In conclusion we have a strong belief that our app can help both individuals and businesses acknowledge and reduce their carbon footprint so that we can meet the Net Zero Emissions goal of the Paris Agreement.

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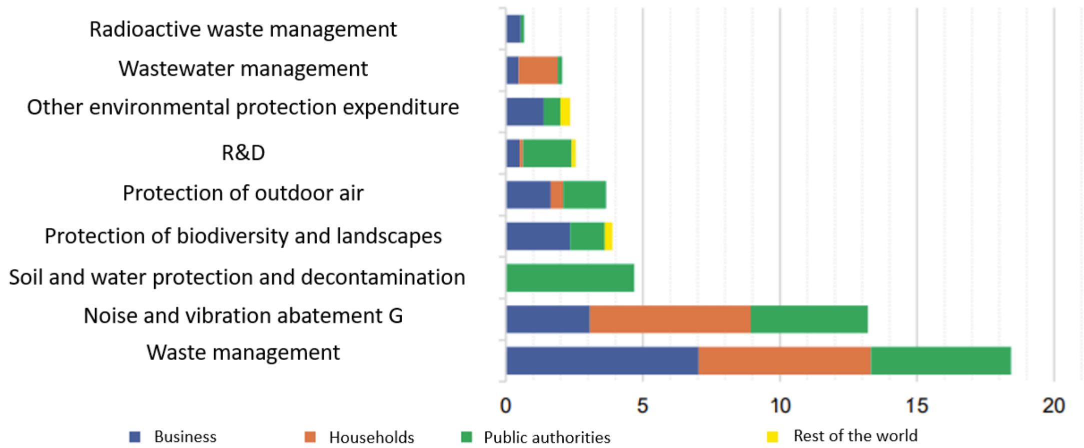
ssions/#:~:text=In%202022%2C%20international%20shipping%20alone,contributor%20to%20global%20carbon%20pollution.

6. Appendix

6.1 Appendix for the introduction

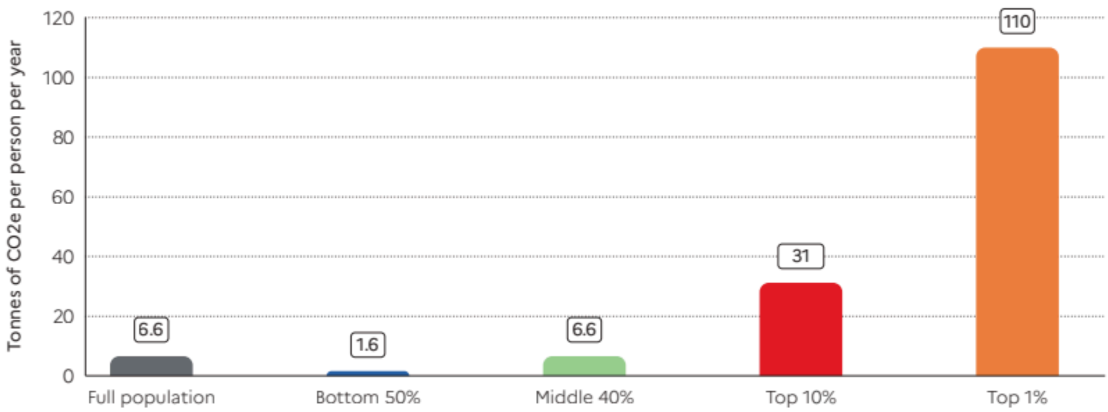
graph 1:

Financing of environmental protection expenditure by area and financing agent, in 2020
In billions of current euros



graph 2:

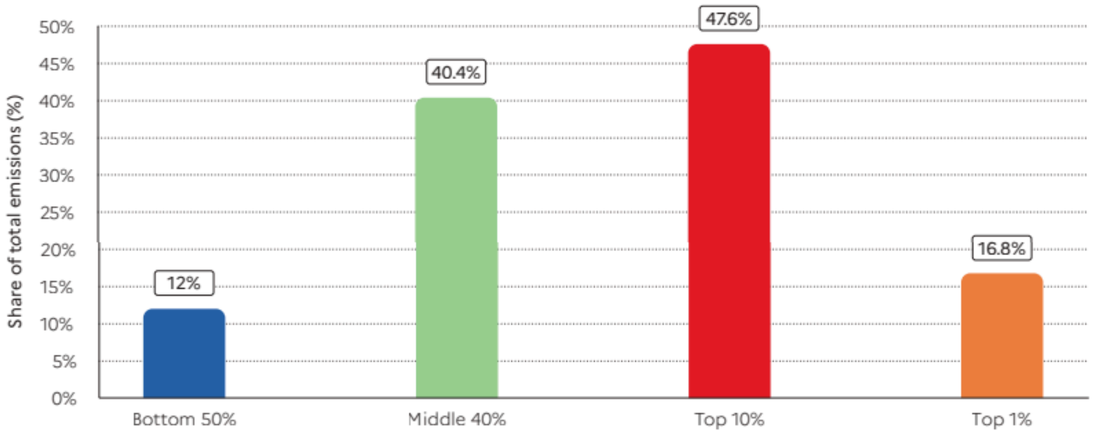
Figure 6.5a **Global carbon inequality, 2019: emissions by group**



Interpretation: *Personal carbon footprints include emissions from domestic consumption, public and private investments as well as imports and exports of carbon embedded in goods and services traded with the rest of the world. Modeled estimates based on the systematic combination of tax data, household surveys and input-output tables. Emissions split equally within households.* **Sources and series:** *wir2022.wid.world/methodology and Chancel (2021).*

graph 3:

Figure 6.5b ***Global carbon inequality, 2019. Group contribution to world emissions (%)***



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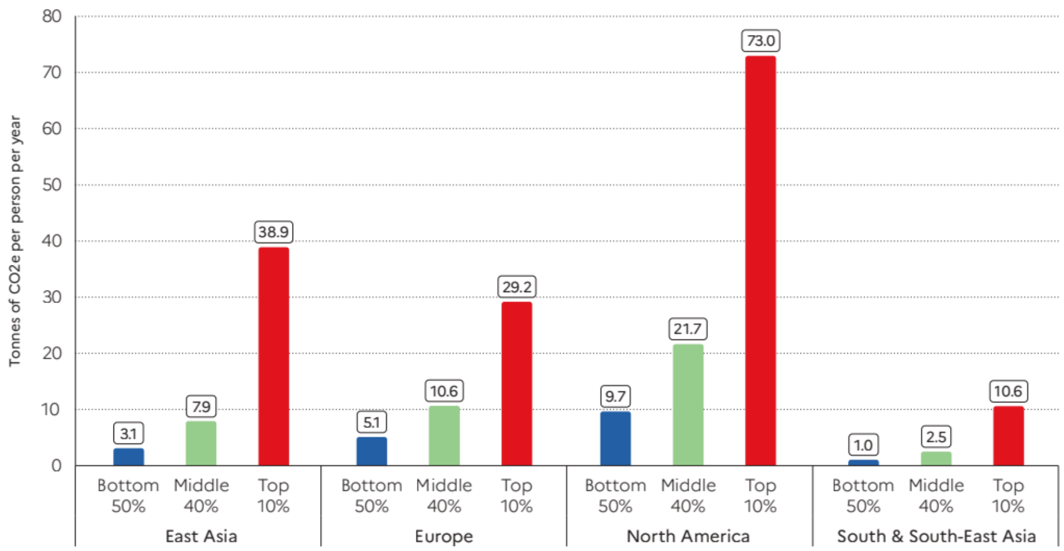
graph 4:

Figure 6.4a ***Per capita emissions across the world, 2019***



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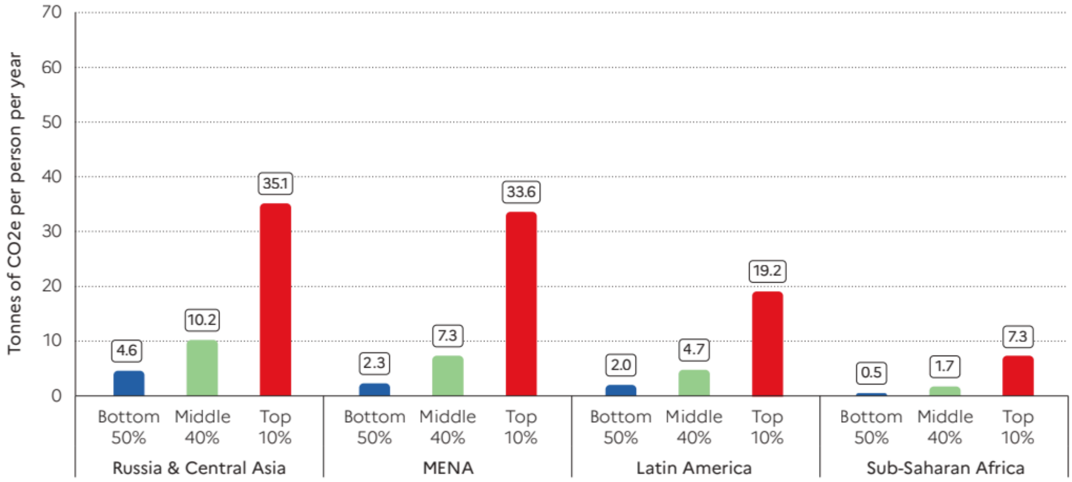
graph 5:

Figure 6.4b ***Per capita emissions across the world, 2019***



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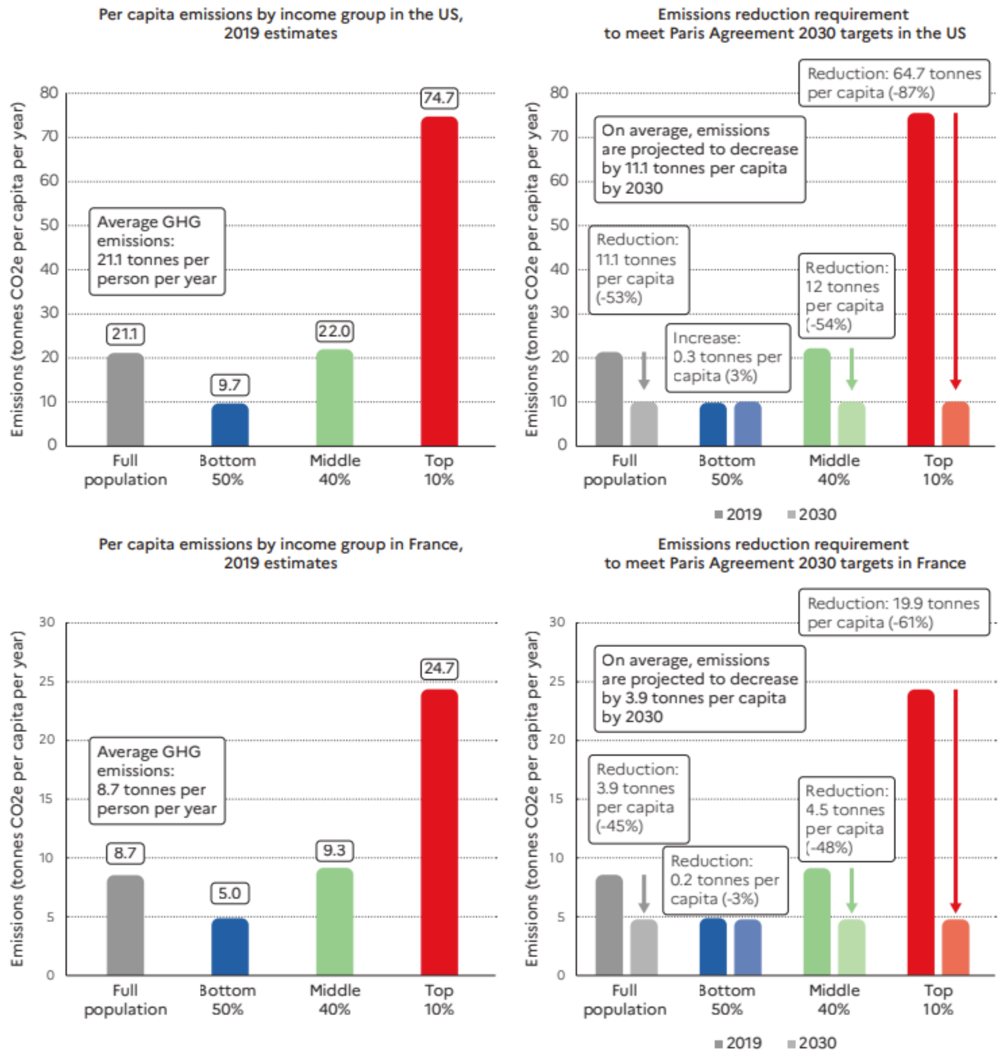
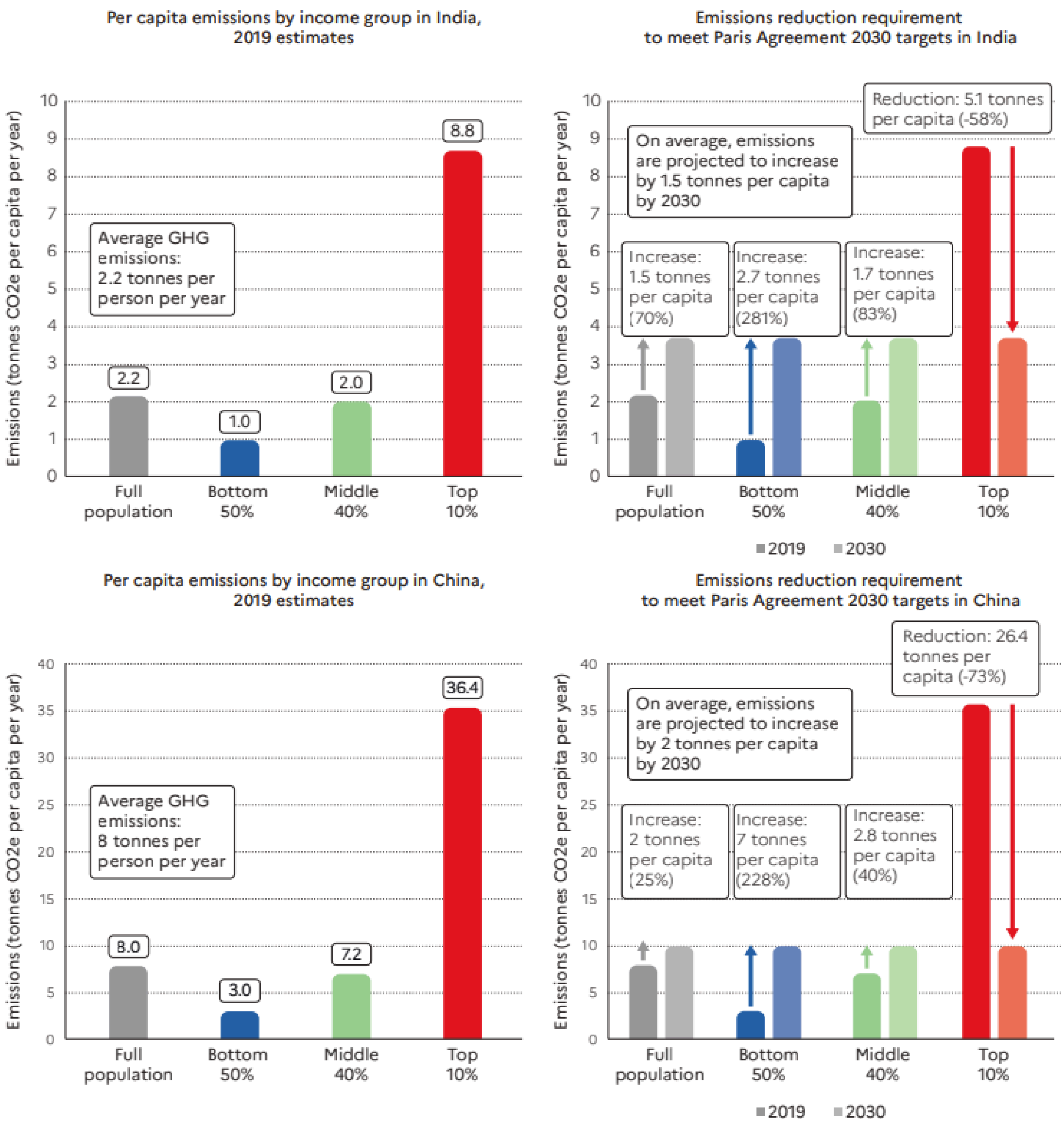
graph 6:

Figure 6.10abcd ***Per capita emissions by income group and reduction requirements to meet Paris Agreement targets in the US, France, India, and China***



graph 7:



6.2 Appendix for the methodology

Emissions table:

Transport Method	Emission in CO2_eq per kilometre
Motorbike	0.114 kg
Diesel car	0.171 kg
Petrol car	0.192 kg
Hybrid car	0.068 kg
Electric car	0.047 kg

Bus	0.097 kg/passenger
Domestic flight	0.246 kg/passenger
Short-haul flight	0.151 kg/passenger
Long-haul flight	0.147 kg/passenger
Electric train	0.004 kg/passenger
Diesel train	0.041 kg/passenger
Ferry as person	0.0187 kg/passenger
Ferry as passenger of car	0.1295 kg/passenger