Carbon App: Paper

Green Digitalization and App Development

Group 3 NHH – Spring 2025

Introduction

Climate change has become one of the most difficult issues of our time, and it can seem like a distant problem that will only affect future generations. Unfortunately, its consequences are already here, from making winters slightly warmer to an increase in natural disasters. A major contributor to climate change is carbon emissions, with transportation playing a significant role. Everytime we commute to work, take a weekend trip, or fly somewhere, we emit carbon.

This is where our Carbon App comes in. Our goal is to help individuals understand and reduce their carbon emissions by making data on transport emissions easily accessible and actionable. We want to make it as easy as possible for users to see the environmental impact of how they travel, and help them make more eco-friendly choices when they can.

This paper outlines our methodology for calculating carbon emissions, the sources of information we utilize, and our comprehensive business model.

How do we Calculate Carbon Emissions?

Our app calculates carbon emissions using key variables such as fuel type, travel distance, and energy efficiency. By entering trip details, including distance, vehicle type, fuel used, and number of passengers, users can estimate their emissions and compare the environmental impact of different means of transport.

We use this general formula for each means of transport:

$$CO_2 = d * (fe/p)$$

- *fe*: emission factor in CO_2/km
- *d*: distance
- *p*: number of passengers

For means of transport like planes, busses, and ferries, we use this formula:

$$CO_2 = d * fe$$

In this formula, we do not take into account the number of passengers. This is because the emission factors for these transport modes are typically calculated based on average occupancy and operational efficiency, making the per-passenger calculation less relevant.

Different Means of Transport and How they are Calculated

Our calculations adhere to Euro Emissions Standards, which set strict limits on pollutant emissions from vehicles. These standards ensure that our estimates are accurate and comply with regulatory requirements, providing users with reliable data to make informed decisions about their transportation choices. Our sources ensure that our data is up-to-date and accurate, allowing users to trust the emissions calculations provided by our application.

Cars

According to the Worldwide Harmonised Light Vehicles Test Procedures (WLTP) in 2019, CO_2 emissions for cars by fuel type are as follows:

- Gasoline: $120 - 180\ g/km$
- Diesel: $100 - 160\ g/km$
- Hybrid (gasoline): $50 - 100\ g/km$
- Electric: $26\ g/km$ (In the Nordic countries, but this depends on electricity generation)
- LPG / CNG: $100 - 130\ g/km$

For example, a gasoline car that consumes $6\ L/100\ km$ emits approximately:

$$6\ L\ *\ 2.3\ kg\ CO_2\ /\ L\ =\ 13.8\ kg\ CO2\ /\ 100\ km$$

Or $138\ g/km$

(Gasoline produces approximately 2.3 kg of CO_2 per litre burnt, diesel approximately 2.6 kg/L).

Train

In Norway, train transportation is managed through a collaboration among several companies. We will incorporate data provided by Vy for train-calculations:

- Diesel: $27\ g/km$
- Biodiesel: $14\ g/km$
- Electric train in the Nordic countries: $13\ g/km$

Plane

The French agency of the Ecological Transition (ADEME) has calculated CO_2 emissions for flights:

- Domestic flights (less than 600 km): $250\ -\ 300\ g/km$. For example: Bergen – Oslo.
- Short haul international flights (600 - 3700 km): $150\ -\ 200\ g/km$. For example: Bergen – Paris.
- Long haul international flights (more than 3700 km): $90\ -\ 130\ g/km$. For example: Oslo – New York.

It is important to note that these figures vary according to the type of aircraft, the load factor and the class of travel.

For example, business class can emit two to three times more than economy, because one seat occupies more space in the aircraft. For one row of seats, we can fit six seats in economy class and only two or three in business class. Still, the plane needs the same amount of fuel to fly the same distance regardless of travel class.

Buss

Data according to a study at Chalmers Tekniska Högskola - Metodrapport för Klimatsmartsemester version 4.1 and NHO Transport (numbers are at Vy's website):

- Diesel bus: $30\ g/km$
- Electric bus in the Nordic Countries: $13\ g/km$
- CNG bus: $28.5\ g/km$

Motorbike

Motorbike emissions vary by engine size:

- Electric scooter: $2\ g/km$
- Small scooter (≤ 125cc) (Light city usage, efficient): $60\ -\ 100\ g/km$
- Medium motorcycle (125–500cc) (Urban + peri-urban use): $90\ -\ 150\ g/km$
- Large motorcycle (≥500cc) (Touring, highway bikes): $130\ -\ 200\ g/km$

A motorbike is generally a bit better than a car in CO_2/km, especially smaller scooters. It is important to note that motorbikes, especially older models or 2-stroke engines, emit more local air pollutants (like CO, HC, and NOx) than modern cars.

Ferry

According to FerryGoGo, CO_2 emissions for ferries are as follows:

- Diesel Ferry (foot passenger): $19\ g/km$
- LNG Ferry: $14.25\ g/km$

Walking and Biking

Walking and using bikes produce zero CO_2-emissions, making them the most environmentally friendly modes of transportation.

Business Model

The following section outlines both our current and future business model. It includes an overview of our core features as well as planned additions aimed at expanding the platform's functionality and enhancing the overall user experience. In the future, we plan to expand our app so it not only informs users about their carbon emissions, but also serves as a source of motivation to adopt more sustainable habits. Planned features include challenges, carbon reduction milestones, and achievements, designed to make the app more engaging and enjoyable. Together, these elements form a business model that supports both environmental impact and growth.

Customer Segments

Our primary target group are eco-conscious individuals and companies seeking to reduce their carbon emissions. By catering to both personal and corporate users, we aim to create a broad impact.

Value Proposition

To meet the needs of our two customer segments, our app delivers a set of features designed to reduce carbon emissions. Our app stands out with its personalized dashboards and a distance-based emission calculation system, allowing users to compare the environmental impact of different transportation methods. We will also offer calculations showing how much to offset to our partners to match your carbon entry to further reduce emissions. These features are not only informative, but also designed to build engagement, which we further support through our customer relationship strategies.

Customer Relationships

Our customer relationships are built on active user engagement, motivation, and community support. Currently, progress can be tracked over time with graphs and charts, helping users to visualize the impact of their efforts and set new sustainability goals. Additionally, users can engage with their community outside the app by forming or joining groups with friends, family, or colleagues to collectively combat carbon emissions, share tips, stay motivated, and work toward shared goals.

Our goal for customer relationships is that users can earn points, badges and achievements for reaching specific milestones, such as reducing their carbon emissions by certain percentages or consistently using environmentally friendly transportation. We want customers to be able to compete with friends and the broader user base on leaderboards that rank carbon emission reductions. Weekly and monthly challenges would encourage users to adopt more sustainable habits. The rewards system allows users to redeem earned points for various incentives, including discounts on eco-friendly products, or access to premium app features from our partners. These gamification extensions would further improve our customer relations and is thus a goal in terms of app-development.

Revenue streams

To ensure the sustainability of our business we have developed a revenue model.

We have a Freemium Application. That means that we are offering basic features for free while providing advanced features and services through subscription. Subscription options vary according to user requirements and affordability from NOK 50 to NOK 100 each month.

Subscribers will have an ad-free experience and, in the future, will be the only ones with access to our gamification features described under customer relationships. This translates into a superior experience for the user while creating revenue.

Another way to generate income is within the carbon offsetting marketplace, where users can contribute directly to verified, environmental projects such as reforestation and renewable energy initiatives. Each contribution will pass through our platform, where we take a small, transparent commission to cover operational costs and generate revenue. By integrating this functionality directly into the app, we create both value for the user and a reliable income stream for the company.

Furthermore, we will generate revenue streams by offering solutions for businesses seeking to track and reduce their carbon emissions. Our fleet tracking will help companies meet their environmental goals. This service is offered through a paid enterprise dashboard, providing comprehensive tools for corporate clients. By supporting businesses in their sustainability efforts, we expand our impact and generate additional revenue. Our gamification features are not suitable for a B2B-market, and will not be available for companies seeking our application.

We want to create an environment that sustains both our mission and the goals of our users. Therein lies our revenue model of promoting sustainability while ensuring the application remains solvent. This model thus includes both free and premium offerings, and opportunities for users to contribute towards environmental projects. The discussed income sources above also align with the interests of our user base. Individuals benefit from affordable and impactful options, while companies receive the tools they need to meet growing regulatory and stakeholder demands for sustainability reporting.

Key Partnerships

Strategic partnerships play a vital role in delivering value to our users and expanding our impact. We will work with organizations whose missions align with our sustainability goals, including green-energy companies and sustainable brands. Such partnerships allow for the promotion of sponsored eco-friendly products and services through the app, where users can get special offers and promotions for the usage of reward points from our gamification features. These partnerships will also help with carbon-offsetting in the form of links to partnering websites, where you can offset based on your entries in the app.

Channels

Our primary channel for delivering the service to individual users is our mobile app. For companies, we offer a dedicated enterprise dashboard that provides advanced tools for tracking emissions, analyzing sustainability data, and generating reports. We also use our website and social media platforms for marketing, user engagement, and community building.

Key Resources

Delivering our value proposition requires a combination of technical infrastructure, human expertise, trusted partnerships, and sustainable revenue streams. Our app is deployed in AWS in Stockholm, Sweden, to ensure compliance with European Data Regulation (GDPR).

Cost Structure

Operating our app involves several cost components. These include app development and maintenance, server hosting, and marketing. Additional expenses include licensing fees to publish the app on app distribution channels.

Summary

Carbon App is designed to help users understand and reduce their carbon emissions from transportation. With climate change becoming more and more relevant, the app helps by providing tools that encourage more environmentally friendly choices in everyday life. By entering basic travel data like type of transportation, distance, fuel type and vehicle efficiency, the app calculates emissions using reliable sources. Depending on whether per-passenger emissions are relevant, the app uses a specific formula to ensure accurate estimates. Our app uses a freemium model, offering core features for free, and more advanced options through a subscription. It will also include separate dashboards for businesses to track their emissions. A key part of the app's value will be the gamification features, such as leaderboards, challenges and achievements, that are designed to motivate users. In short, the Carbon App is a digital tool with the goal of helping the climate.

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