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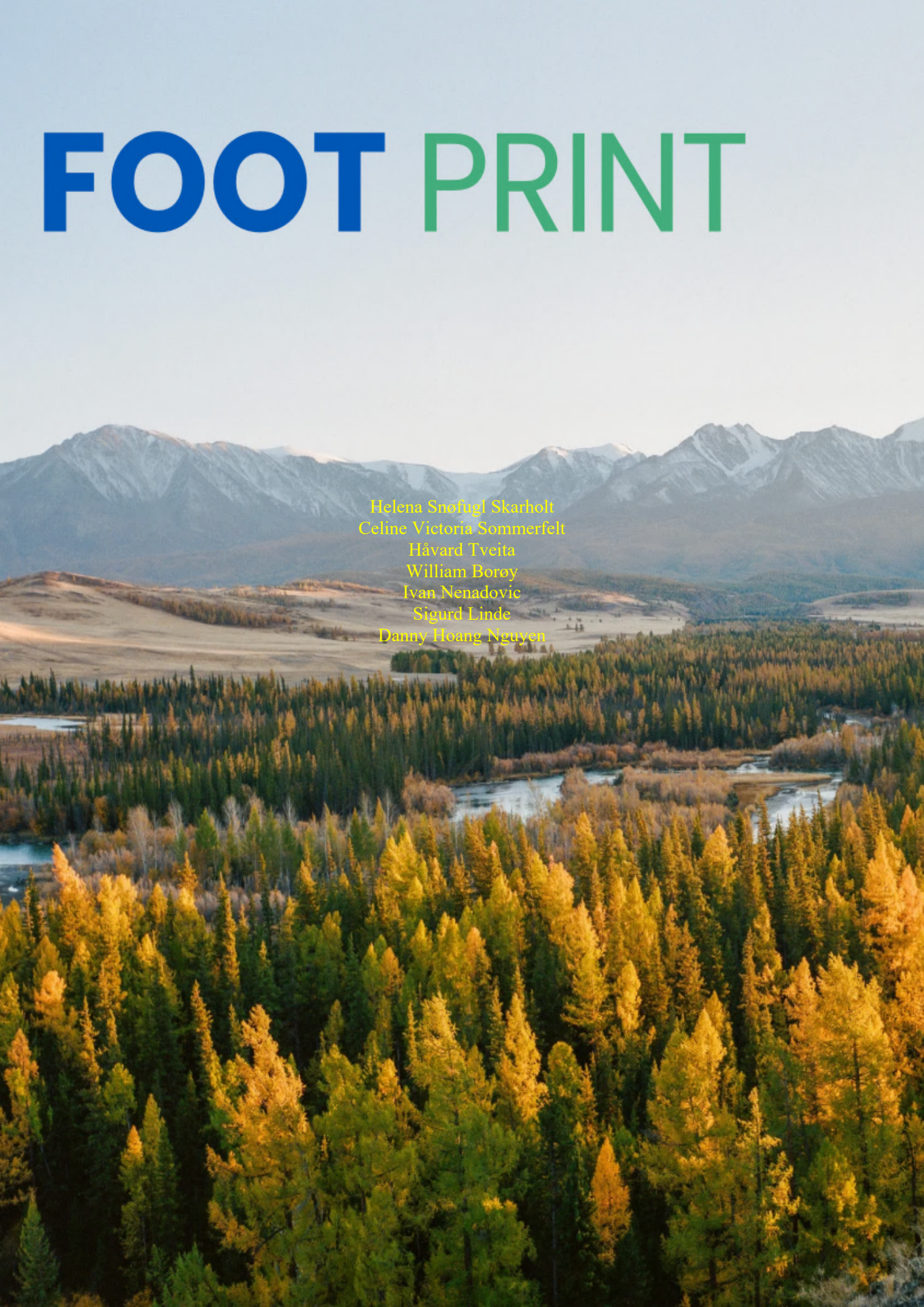

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Introduction

Transportation plays one of the most essential roles when it comes to connecting people, goods, and services, yet it remains one of the largest contributors to global greenhouse emissions. Every year climate change becomes an increasingly more urgent issue, which forwards the importance of developing tools that promote environmental awareness. This paper presents the development and framework of a sustainability-focused project, designed to help individuals understand and reduce their carbon footprint.

Methodology - Approach and data sources

In our work to build a solid methodology, we have conducted thorough research across a range of data sources. Ensuring that our app is based on a relevant and well-founded methodology is essential for it to serve its purpose. For most of our data collection, we have used Chalmers tekniska högskola (2024). We consider this a reliable source, which is also referenced by both VY (n.d) and «fremtiden i våre hender» (Helle, 2025). The only two vehicles we have used a different source for are motorcycles, where the data is taken from Miljødirektoratet (2020), and for electric ferries, from Williment (2025).

When it comes to calculating emissions, this can be done in different ways. One option is a "tank to wheel" approach, which only considers the direct emissions from a vehicle while it is in use. Another approach is "wheel to wheel." This method also includes indirect emissions related to the production of fuel and electricity. In our Methodology we have decided to use this approach, as it provides the most complete picture. In addition, the emission factor for cars includes emissions related to production in the calculation. This is not relevant for public transport, as the volume of passengers transported over its lifetime is significantly larger, and therefore the effect is negligible (Chalmers tekniska högskola, 2024).

For public transport, the emission factor will be calculated as emissions per passenger-kilometre. For cars and motorcycles, we will use an emission factor that applies to the vehicle itself, which can then be divided by the number of passengers. This is a logical approach, as in private transport we know how many passengers are in the vehicle

Assumptions and limitations

It will be necessary for our methodology to be based on certain assumptions. Our goal is for the app to be both user-friendly and accurate. The data we use must be relevant, but it is still intuitive that some simplifications are required to prevent the app from becoming too advanced and complex. We can begin with the assumption regarding the geographical area our methodology focuses on. The data we use will largely be based on Norwegian data and calculations. The differences compared to other

European countries will therefore be smaller than for regions elsewhere in the world, where emissions differ even more from those in Norway.

Furthermore, it is necessary to make certain assumptions regarding traffic and the age of vehicles. These are variables that will naturally affect emissions but are difficult to estimate, as there are almost unlimited details that could be included in the calculations. In our methodology, this is therefore represented by an average value.

The same applies when calculating emissions for certain types of public transport. When calculating emissions per passenger for airplanes, trains, ferries, and buses, we will use an average number of passengers to represent a typical "trip." This is necessary since users generally do not know how many passengers the total emissions should be distributed among. This problem disappears in the calculations for cars and motorcycles, though it results in a small adjustment to the formula shown below.

Our formulas

In our Methodology, we will distinguish between two general formulas. The formulas are based on the same fundamental calculation, which is that total CO2 emissions equal distance multiplied by the emission factor. The formulas differ in how they handle passengers: for public transport, we use an average value per passenger-kilometre, while for cars and motorcycles, we divide the total emissions by the number of passengers.

This gives us the following formulas:

Public transport:

$$CO_2 = Distance * Emission\ factor$$

Cars/Motorcycle:

$$CO_2 = Distance * \frac{Emission\ factor}{Passengers}$$

Where:
CO2 = The total amount of CO2 emission for each trip
Distance: Measured in kilometres
Emission factor: Based on average emission per km for the given means of transport

The formulas are taken from the GHG Protocol (2013) and are referred to as activity/distance-based formulas. This is clear since we multiply distance in kilometres by the emission factor.

Human powered

The most environmentally friendly forms of transport are the ones powered by human energy. We do not emit greenhouse gases when walking or cycling. In addition to being more environmentally friendly, these modes of transport also contribute to better health and less noise. We have therefore chosen to include human-powered means of transport in our app in the form of walking and cycling.

Car

According to VY (2023), road traffic in Norway accounts for as much as 18% of the country's annual CO2 emissions. A large part of this is caused by cars. In our methodology, we distinguish between three types: diesel, petrol, and electric cars. The emissions for diesel are 229 g/km, and for petrol 198 g/km. Here, production emissions are calculated as 10% of the total. For electric cars, the emissions are 59 g/km, where production emissions make up 69% of the total. As previously mentioned, we choose to include this in our methodology to show the full picture. The emission refers to the emissions from the vehicle itself. In the app, the emission factor can be divided by the number of passengers.

Motorcycle

Motorcycles are flexible means of transport that take up less space, often reach their destination faster, and use less fuel than cars. At the same time, their emissions are considerable, as most motorcycles still are powered by fossil fuels. Electric alternatives are still relatively limited, which is why we have chosen not to include them in our app. According to Miljødirektoratet (2020), the emissions from motorcycles are 95 g/km.

Bus

Compared to cars and motorcycles, buses are a more environmentally friendly option, as the emissions per passenger are lower. This effect is even greater now that more cities have switched to electric buses, which significantly reduces emissions. In our app, we therefore distinguish between diesel and electric buses. The emissions from electric buses are 13 grams per passenger-kilometre, while diesel buses emit 30 grams per passenger-kilometre.

Train

Trains are a major part of Norway's transportation system. Nevertheless, the emissions associated with the railway account for less than 0.1% of Norway's annual CO2 emissions (Vy, 2023). This means that trains are generally a very environmentally friendly alternative. The emissions from diesel-powered trains are 91 g/passenger-km. For an electric train in the Nordic countries, the emissions are

significantly lower at only 7 g/passenger-km. The emissions from electric trains are related to indirect emissions from electricity production.

Airplane

Air travel is a fast mode of transportation that efficiently connects people. At the same time, it is a form of transport with a significant environmental impact, as they still mainly operate on fossil fuels. We will divide air travel into two categories: economy and business class. The emissions per passenger-kilometre for economy class are 127 g. while business has emissions of 284 g per passenger-kilometre.

Ferry

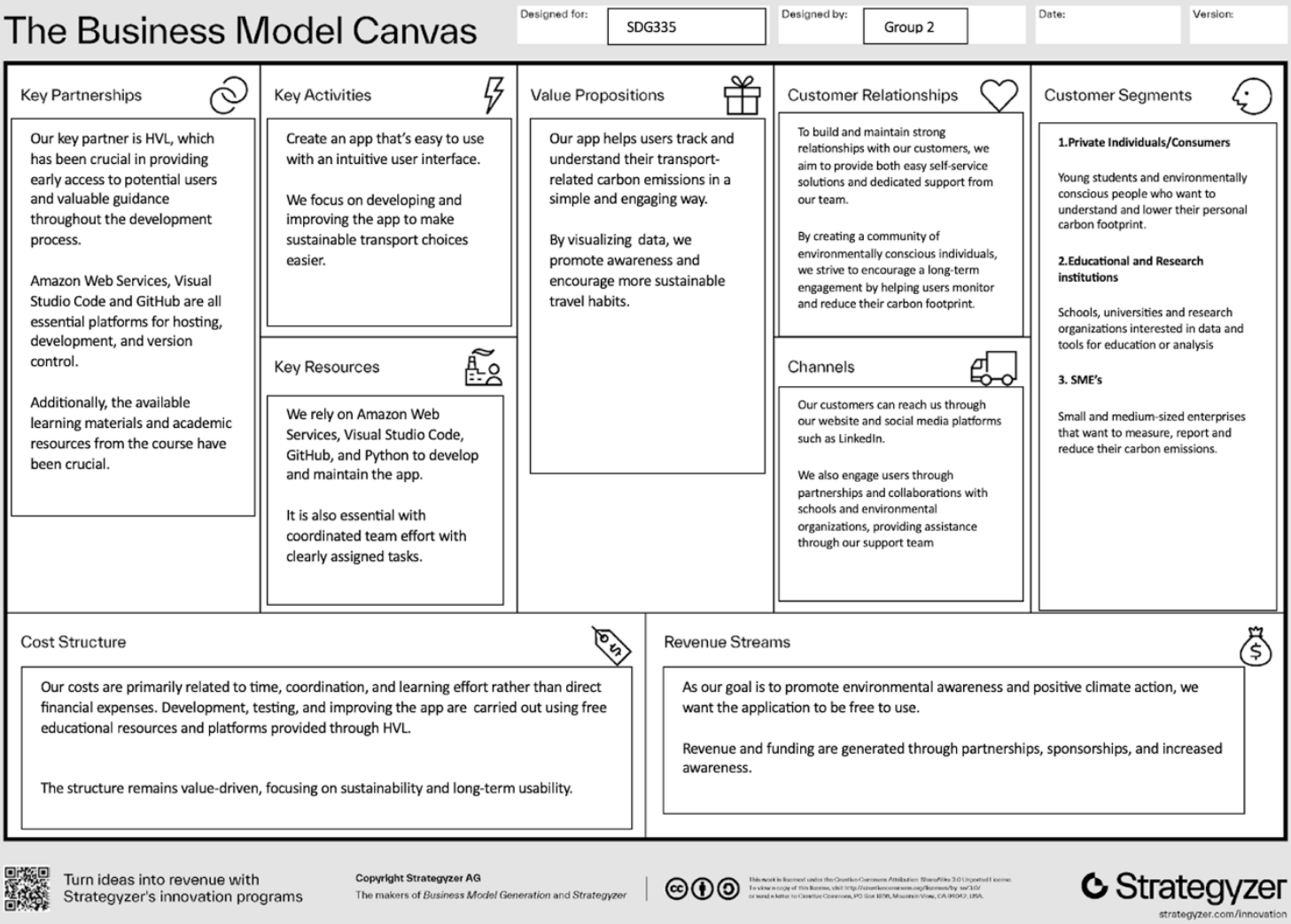
Emissions from ferry operations in Norway have declined by 50% over the past ten years, according to Statens vegvesen (2025). This has happened at the same time as ferry traffic has increased. The CO2 emissions associated with a fossil-fueled ferry are 186 g per passenger-kilometre. Since the implementation of electric ferries is still in its early stages, it is challenging to find precise emission figures. We therefore use data from a new ferry in Stockholm, where CO2 emissions are only 23 g per passenger-kilometre (Williment, 2025). Although the emissions from electric ferries are significantly lower, replacing traditional ferries is a very costly process. This is a major reason why the transition has not progressed further yet.

Bybanen

For this app to be user-friendly for students (especially in Bergen), we will also include the light rail or “Bybanen”. The emission factor related to the light rail is difficult to find information on, so we will make an estimate based on some key figures. Skyss (2024) reports that the number of boardings in 2024 was 25,9 million. Skyss (2022) also reports that the total emissions related to the light rail in 2022 were approximately 200 tons of CO2. This gives us 7,7 g per boarding. If we assume that an average trip on the light rail is 5 km, we end up with an emission factor of 1,5 g CO2 per passenger-kilometre.

How we work

We are a group of 7 individuals from different parts of Norway. Through weekly meetings and open discussions, we made key decisions



The business model

Our business model is built around one clear idea: helping students understand their transport-related carbon emissions in a simple, visual, and motivating way. What makes our app different from other calculators is that it focuses on the transport modes young people actually use. Especially buses, the "bybane", walking, and cycling – and turns this information into clear and personal insights.

Our main users are students aged 18-30, a group that travels often but usually has limited time and money. By tailoring the app to their daily travel habits, the results feel more relatable and useful. This also explains why our methodology uses local and student-relevant emission factors instead of generic global data.

The value we offer is a tool that makes carbon emissions easy to understand. Instead of long reports or complex numbers, the app gives users quick visual feedback that helps them reflect on their daily choices. The purpose is educational and supportive, not commercial.

Our key activities focus on building and improving a lightweight, user-friendly app. We work mainly with reliable data, simple design, and continuous testing with students to make sure the tool stays relevant and easy to use. The most important resources are the development tools we use (Python, Visual Studio Code, GitHub, AWS) and the guidance we get through HVL.

Since the project is value-driven rather than profit-driven, the app is free to use. Costs are kept low by relying on open-source tools, and any potential funding in the future would come from sustainability-related support rather than commercial fees.

Customer relationships are built on clarity and trust. We want users to feel supported, not pressured, and we aim to create engagement by showing emissions in a way that feels personal and meaningful. Our main channels are the app itself, and the communication through student networks and social media platforms such as LinkedIn.

Inspired Strava friend system

In the future we want to innovate our app to the social "friend system," inspired by Strava. While most carbon apps focus on individual tracking, we believe that climate action is growing stronger through connection. Our friend system allows users to add friends, form groups, and compare their progress in reducing transport related emissions. This can be more motivating for people, rather than working with their carbon emissions alone.

Here's how it works

Each user has a personal profile showing their total CO2 savings and travel history.
Friends can follow each other's journeys, send motivational messages. We would like to have different challenges like a week of zero emission commuting. Users can join leaderboards either among friends, within their university, or across Norway to see who's making the biggest impact on our planet. Monthly eco-challenges like "Bike-to-campus month" or "Public Transport Week" reward users with badges, ranks, and recognition.

This Strava inspired system combines the motivation of competition with the value of collaboration, creating a motivating platform where students inspire each other to travel greener. We make climate action both fun and meaningful and importantly, and sustainable in the long run.

While our current version focuses on helping individuals understand their transport related carbon footprint, our long-term vision goes far beyond that. We want to build a living sustainability platform, one that grows together with its users and adapts to the changing world of green technology.

In the next stages of development, we aim to expand in three key directions:
We are visioning integrating student organizations, universities, and local communities into the

platform. We imagine universities competing in sustainability challenges together. Or also, student groups working together to achieve collective emission reduction goals.
This way, our app can become a hub for climate engagement.

With improved data analysis and optional GPS integration, the app will be able to suggest personalized travel alternatives by for example recommending a greener route, estimating savings in real time, or comparing seasonal travel patterns. By giving users smart feedback, we make every small choice feel meaningful.

Our long-term goal

Our goal is not just to measure emissions, but to build movement. We want to redefine how students think about everyday travel. Transforming small personal choices into a collective impact. Choosing a greener way to move shouldn't feel like a sacrifice, it should feel like belonging to something bigger "a global generation that acts on what it believes in".

We also imagine expanding beyond transportation. In future versions, the app could include other lifestyle categories such as food, energy use, and shopping creating a complete personal sustainability profile. This would allow users to track their total environmental impact. They will also receive recommendations on how to live more sustainably, step by step.

Our long-term vision isn't just about technology, it's about culture. We want a cultural shift where sustainability becomes socially rewarding, visible, and fun. By linking the app to student life through events, campus challenges, and local partnerships. We want to make greener choices a natural part of everyday routines.

We see our app as a bridge from awareness to action. It helps students understand their footprint and feel proud of improving it together. By combining data with simple design, it motivates individuals. We hope to create a platform that inspires a generation to move differently in a greener way, not because they must, but because they want to.

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