

# GREEN MOBILITY

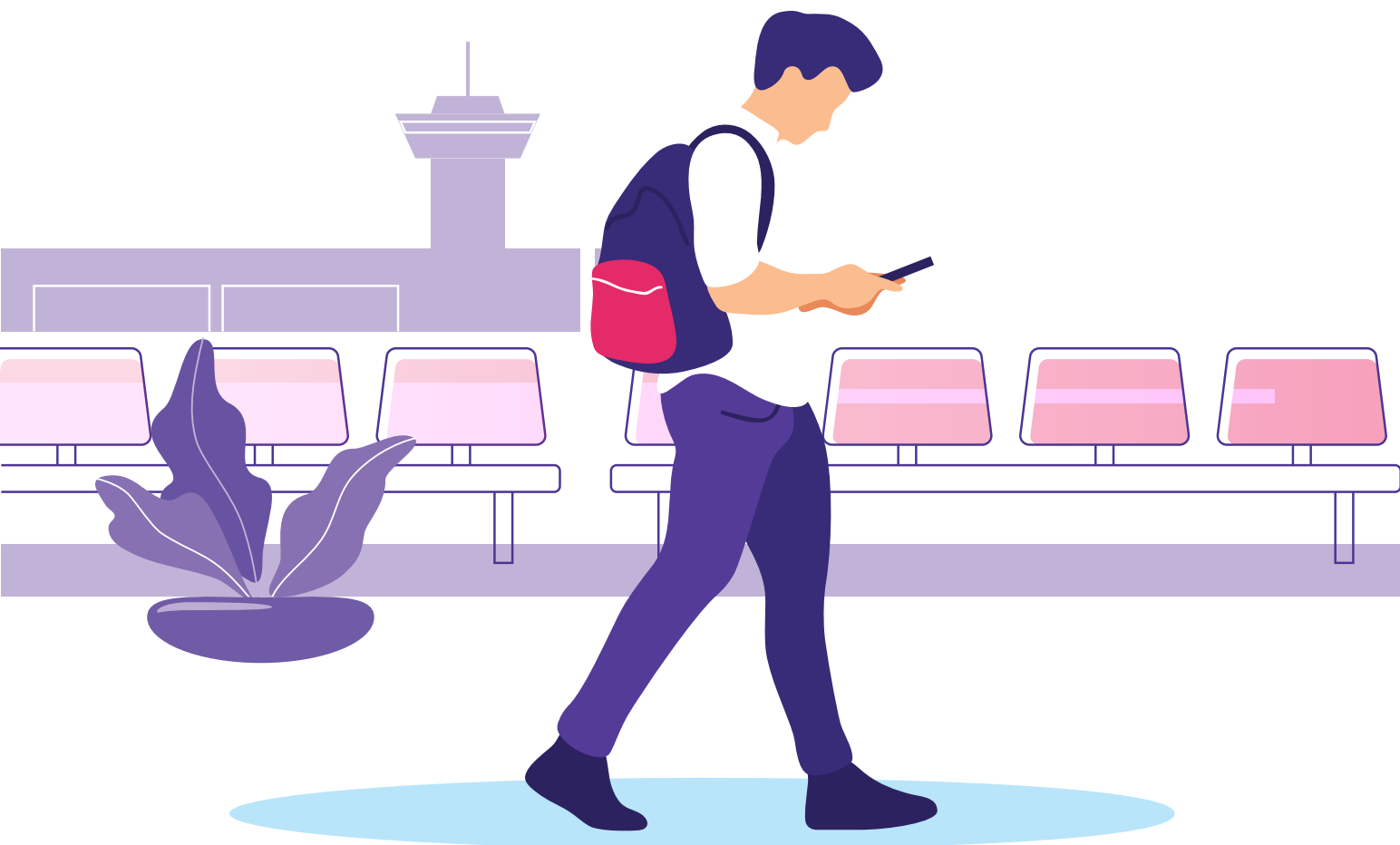
WHITEPAPER



Developed by **CarGo Green Technologies**

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# 1. Introduction

Climate Change presents the greatest threat to our planet. Global warming is mounting up at a steady pace. Last four years were the hottest recorded. Additionally, we are starting to notice the life-threatening impact of Climate Change, the rise of sea levels, increased rainfall and more extreme drought, dying of coral reefs, air pollution, heat waves, food security, etc. Moreover, it is noted in the 2018 report of the Global Commission on Climate and Economy that disasters triggered by weather and climate-related risks are estimated to have been responsible for **millions of deaths and more than \$300 billion in losses worldwide in 2017 alone**.

**The Paris Agreement (COP21) ratified in 2016** presents a global action plan to tackle Climate Change. Under the United Nations as a facilitator, 181 countries signed an agreement to respond to the environmental, social, and economic effects of Global warming. It is not just governments who need to redesign their approaches, but businesses as well, in order to respond properly. **In October 2018**, the UN Intergovernmental Panel on Climate Change said that "rapid, far-reaching and unprecedented changes in all aspects of society are needed to avoid disastrous levels of Global warming.

" **By 2050**, in order to limit Global warming, emissions produced by humans will need to be net zero. The transition to Carbon Neutral Economy has begun and all actors will need to play an important role in this process.

Transportation as a relevant component of this development is already being disrupted by new digital trends, such as service providers and ride-sharing options. Car manufacturers are changing their business models and adapting to the new market trends in order to facilitate newly established consumers' needs. Government regulations, the rise of electric vehicles, carbon trading, customer's behaviour and other initiatives present new mechanisms on how to cut down Greenhouse gas emissions. However, it is not enough. Therefore, this White paper presents an innovative approach on how to combine certain climate-friendly instruments and create an ecosystem which will curb down the emissions and contribute to the Carbon Neutral Economy.

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Photo 1 Source: <https://vietnamnews.vn/environment/464607/hcm-city-seeks-ways-to-curb-co2-emissions-from-vehicles.html#kOe5mfAJUQBpX8xY.97>

## 2. Sources of greenhouse gas emissions

Over the last 150 years (from the beginning of the industrialization) human activities are predominantly responsible for the rise of emissions of Greenhouse Gases. These activities can be divided as follows (more details on Photo 2 below):

- Electricity and heat production
- Industry
- Agriculture, Forestry and other land use
- Transportation
- Buildings
- Other sectors

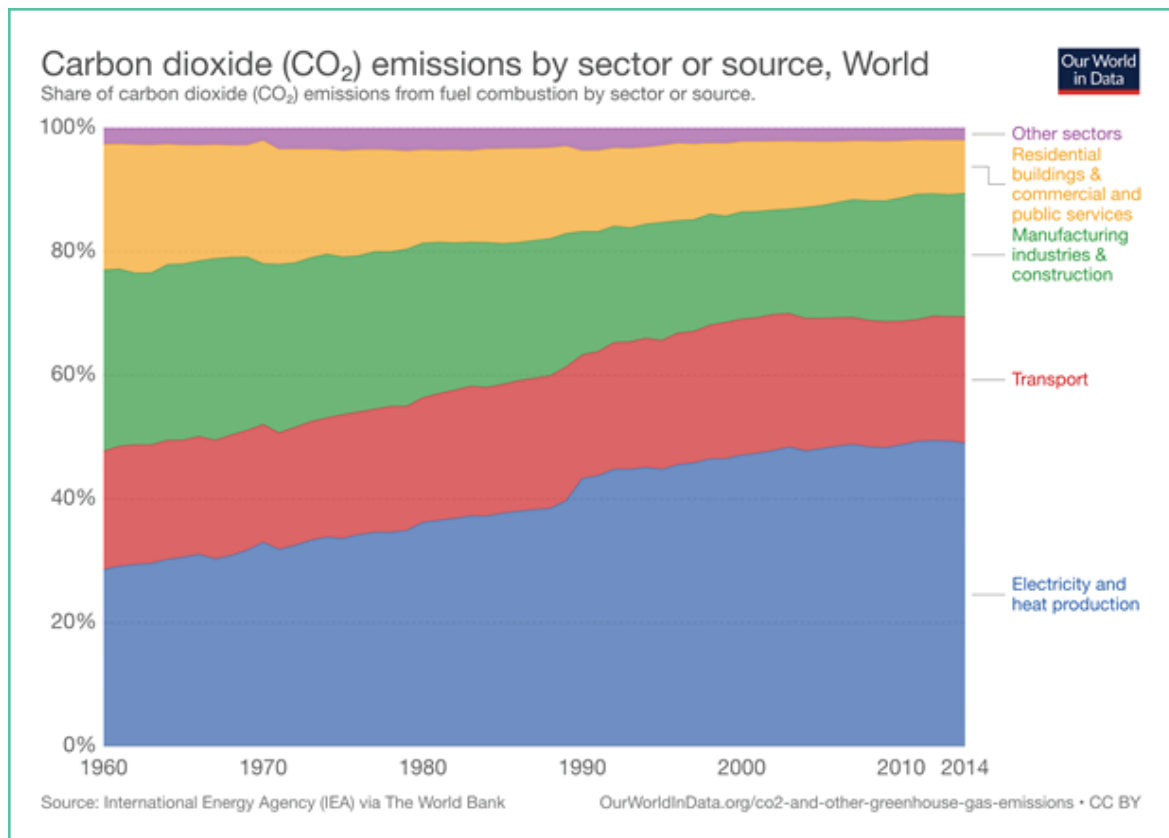


Photo 2

Most emissions come from the combustion of fossil fuels in cars, buildings, factories, power plants (agricultural and industrial activity).

**Carbon dioxide (CO<sub>2</sub>) is the most responsible gas for Global warming.** Others are methane (released from landfills), natural gas and petroleum industries, and agriculture (from the digestive systems of grazing animals), nitrous oxide from fertilizers, gases used for refrigeration and industrial processes and on the other hand, the loss of forests that would otherwise store CO<sub>2</sub>.

### 3. Transportation

Factors such as globalization and higher living standards have contributed to the boost of tourism movement (both passenger and freight). That trend started at the end of the 20th century and is expected to continue to grow through to 2050. As a sector, transportation is one of the biggest contributors to Greenhouse Gas Emissions by nearly 20% in total and it is the most responsible for the fastest growth of CO<sub>2</sub> emissions (Photos 3 and 4).

The largest source of these emissions comes from passenger cars and light-duty trucks, including sport utility vehicles, pickup trucks, and minivans. In total, they account for over 70% of all emissions caused by the transportation sector. It is one of the predominant sectors that needs decarbonization. The remaining greenhouse gas emissions come from other forms of transportation:

- Freight trucks
- Commercial aircraft
- Ships
- Boats
- Pipelines and lubricants
- Trains

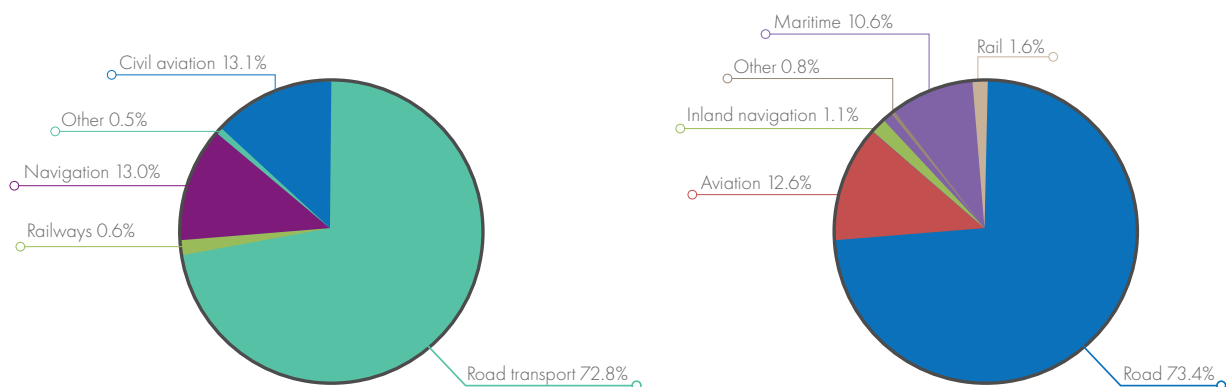


Photo 3 Source Greenhouse gas emissions from transport by mode and share of transport energy demand by mode in 2014 Source: [https://ec.europa.eu/clima/policies/transport\\_en](https://ec.europa.eu/clima/policies/transport_en)

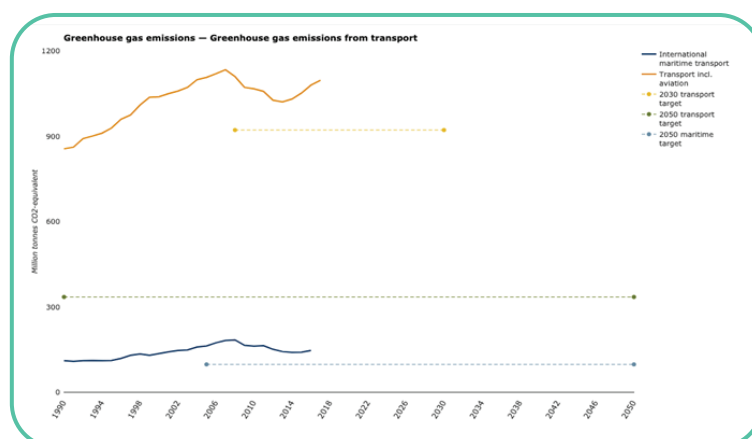


Photo 4 Greenhouse gas emissions from transport including aviation, but excluding international shipping.

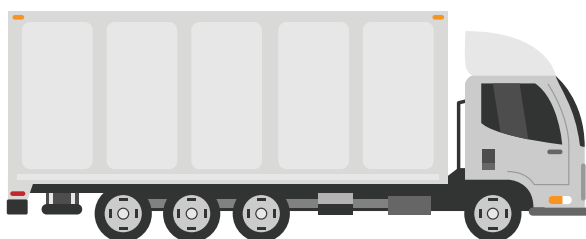
The automotive industry is a complex mixture of vehicle manufacturers, component and equipment suppliers, service providers, and smaller local companies that contribute to sales and distribution sectors. All the aforementioned actors need to address climate change strategically. The shift to electric and autonomous vehicles is becoming progressive and manufacturers and service providers need to adapt to these challenges promptly.

In order to meet the 2050 Paris Climate criteria road transportation needs to be transformed, especially decarbonization of cars and vans. With traffic congestion causing increasingly high costs, public transport and alternative ways of transportation must be enhanced too. To reduce carbon emissions by more than 90% and to decarbonize the fleet by 2050, sales of new cars and engines must end by 2035. Since it is not feasible to fully decarbonize aviation and shipping by 2050, important stakeholders focus their policies and strategies on road transportation.

Nearly 30% of the total CO<sub>2</sub> emissions in the EU is caused by transportation, out of which 72% comes from road transportation (Photo 5). The main emitters are passenger cars (accounted for 60.7% of total CO<sub>2</sub> emissions from road transport), followed by heavy-duty trucks, light-duty trucks and motorcycles. Globally, one-quarter of CO<sub>2</sub> emissions from fuel combustion is generated by transport, out of which three quarters are coming from road transport according to the International Energy Agency report.

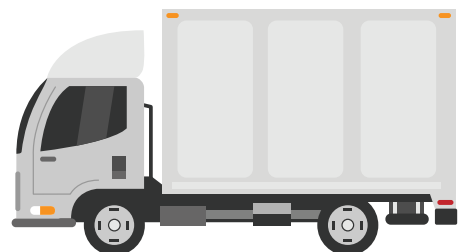
## CO<sub>2</sub> EMISSIONS

26.2%



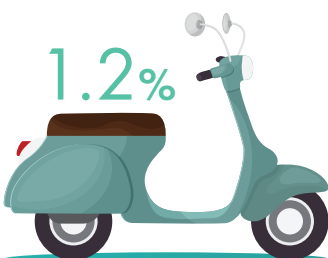
Heavy duty trucks

11.9%



Light duty trucks

1.2%



Motorcycles

60.7%



Cars

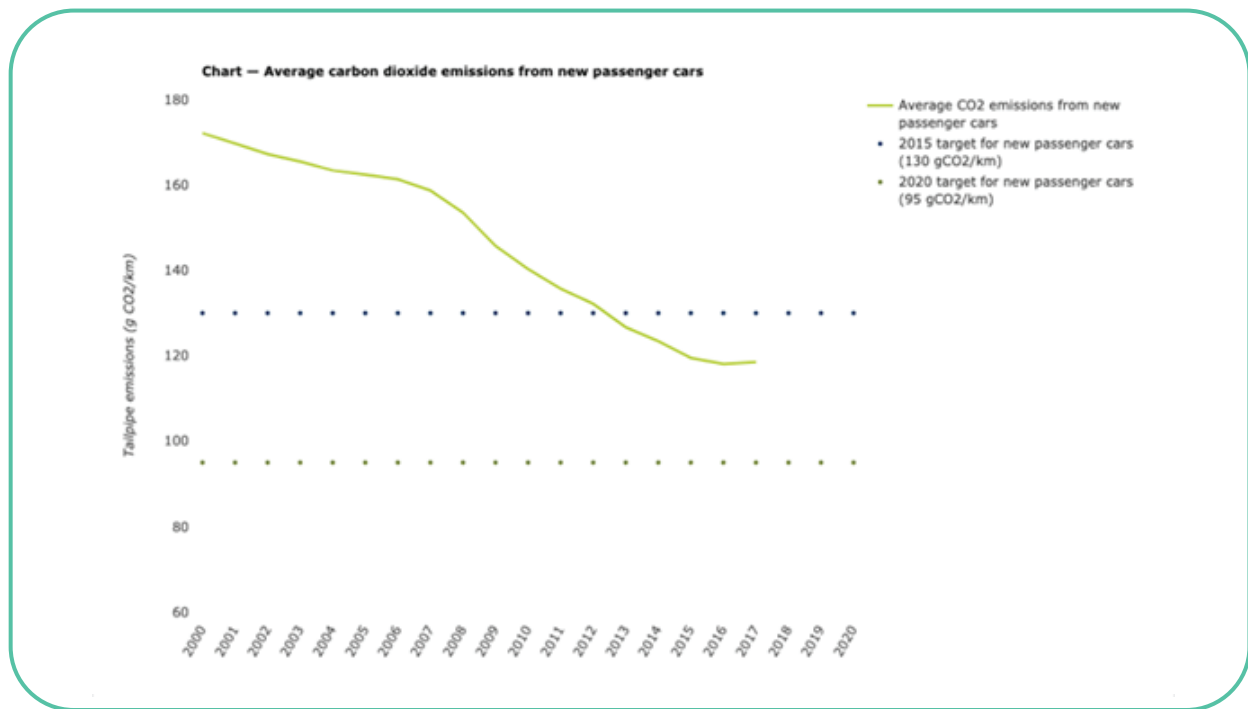


Photo 6 Source: <https://www.eea.europa.eu/data-and-maps/indicators/average-co2-emissions-from-motor-vehicles/assessment>

According to the US Environmental Protection Agency, a typical passenger vehicle emits roughly 4.7 metric tons of CO<sub>2</sub> annually. Pollution caused by road transport depends significantly on the transport mode, driving style and car quality. Introduction of cleaner technologies in modern cars was followed by implementation of stronger engines that consume more fuel and energy, which counterbalanced the improvement. The table below shows CO<sub>2</sub> emissions by engine type. The 2015 goal of the EU was to limit the emission at 130g/km, which was achieved before the deadline. At the moment, the EU aims to reach the 2020 goal of 95g CO<sub>2</sub>/km, as shown in the table below.

Engine type	Average emission (gCO <sub>2</sub> /km)
Diesel	117.9
Petrol	121.6
LPG	83
CNG	113
PHEV	42
EV	0



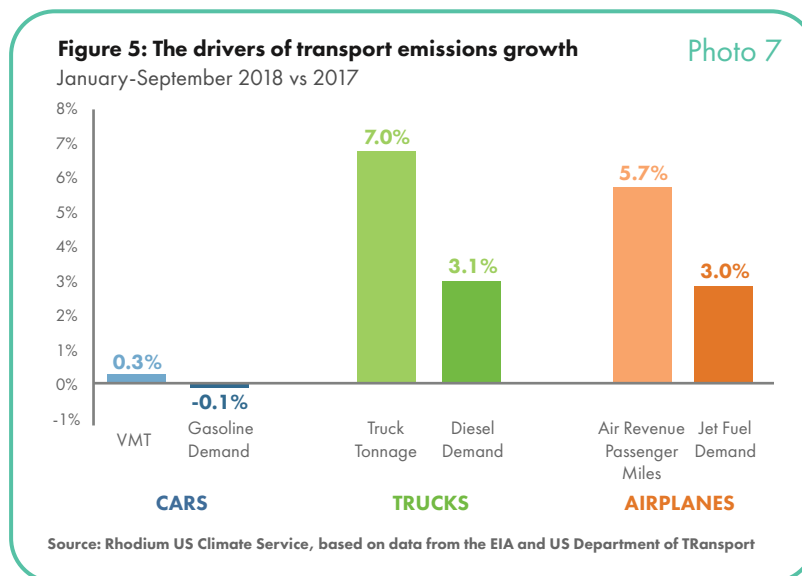
Engines using LPG and CNG are much smaller polluters with an average of 83g of CO<sub>2</sub> for LPG and 113g for CNG. At the same time, vehicles emit relatively small amounts of methane, nitrous oxide and hydrofluorocarbon during fuel combustion.

However, electric vehicles, regardless of driving style and manufacturer, produce zero direct emissions (smog-forming pollutants and greenhouse gases). Their life cycle pollution is relatively low to those of engine vehicles, which depends mostly on electricity mix that varies by geographic location. Another benefit of driving an electric car is its efficiency. When it comes to conventional vehicles, their internal combustion engines are able to convert only about 17-21% of the available energy in gasoline to kinetic energy, used to move the car. On the other hand, electric vehicles are far more efficient with their ability to convert 60-77% of a given energy. These figures show that electric vehicles are four times more efficient than gas-powered, and two times better than the most efficient hybrid. Higher efficiency of electric cars means they are also more cost-efficient. Moreover, with less moving parts with an ability to break down, electric cars have lower maintenance costs. Investing in electric vehicles results in long-term savings. Consequently, electric cars are the best solution for fuel-efficient, high-performance, and low-emission transportation. Also, over time as technology improves, battery-powered cars are likely to get even more efficient compared to the existing levels.

The International Council on Clean Transportation 2018 report predicts that electric vehicles could face a dramatic decrease in price compared to conventional cars. Prices are affected by the rising popularity of electric cars, smaller R&D and maintenance costs. The global plug-in electric vehicles market share of 2% (over two million sold vehicles) reached its peak in 2018, which is a 63% increase from 2017. According to the Global Opportunity Analysis and Industry Forecast 2018-2025, the global electric vehicle market was valued at \$118,865 million in 2017 and is projected to reach \$567,299.8 million by 2025.

## 3.1 Aviation

Aviation is another part of the transportation sector which in large part contributes to Global warming. Currently, Aviation presents the fastest growing channel of greenhouse gas emissions (Photo 7). Direct emissions from aviation account for about 3% of the EU's total greenhouse gas emissions and more than 2% of global emissions. That share is poised to grow. If global aviation was a country, it would rank in the top 10 emitters. In 2018 airlines carried 4.3 billion passengers globally, an increase of 38 million compared to the year before.



The EU Commission notes that a person flying from London to New York and back generates nearly the same amount of emissions as the average person in the EU does by heating their home during the whole year (2.1t CO<sub>2</sub>). By 2020, Global International Aviation emissions are projected to be around 70% higher than in 2005 and the International Civil Aviation Organization (ICAO) forecasts that by 2050 they could grow by a further 300-700%. In 2017 Air Transport Action Group declares that the total amount of flights globally produced 859 million tons of CO<sub>2</sub>. On the other hand, humans produced over 40 billion tons of CO<sub>2</sub> on a global scale. according to the International Energy Agency report.



Planes take a large amount of energy just to get off the ground. Therefore, shorter flights actually have a larger CO<sub>2</sub> footprint per passenger, per mile than longer ones, so their overall carbon intensity is higher. Factors that are also relevant to consider are:

- Aircraft age;
- Aircraft type;
- Distance travelled.

Additionally, aircraft emit more than just CO<sub>2</sub>, particles, nitrogen oxides, and sulfates (Photo 8). Moreover, these compounds also trap heat and have an enormous effect on global warming when they are emitted at flight altitude. The new Airbus A380, Boeing 787, ATR-600, Embraer E2 and Bombardier CSeries aircraft use less than 3 liters of jet fuel per 100 passenger kilometers. This matches the efficiency of most modern compact cars. About 1,300 airlines operate a fleet of 31,717 aircraft serving 3,759 airports through a route network of several million kilometers managed by 170 air navigation service providers.

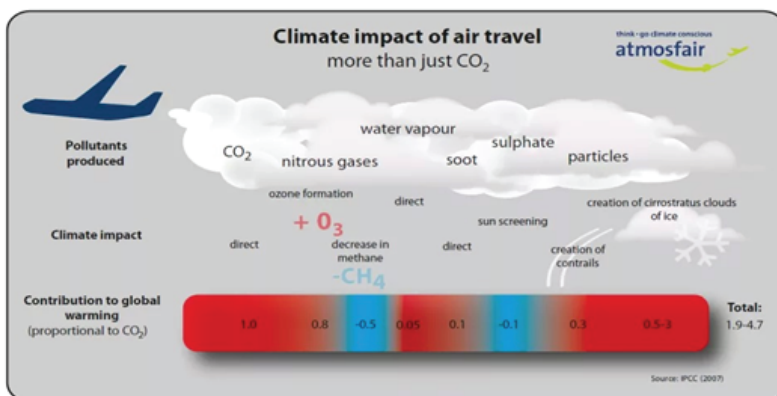


Photo 8 Climate Impact of Air Travelling



## 4. Green Mobility – Reason for Action

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The health, ecological and humanitarian challenges are due to the increase in human-caused activities which emit greenhouse gases. Green energy and disruptive technologies are trends which will shape the future, notably transportation. Additionally, there are other factors that need to be considered:

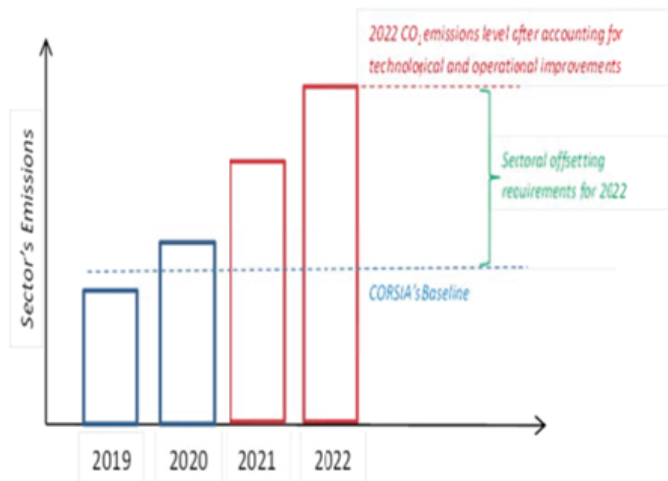
- Rise of urban population and density;
- Rise of demand for mobility;
- The decrease in demand for car ownership;
- New business models.

Due to demographics, market and digital trends demand for urban transport and on-demand transportation will only increase. Contrary, it is expected that the demand for car ownership will decrease in developed countries and urban areas, and an increase in emerging markets (such as China). The progressive pace of life, technology innovation, population growth, threatening global warming, and evolving customer expectations are dictating the future of transportation services. New business models should provide access to cars, rather than ownership. It is possible that the world has reached a peak in auto sales in developed markets, especially having in mind that millennials are more pragmatic about car acquisition than previous generations.

The EU has implemented different measures in order to improve car efficiency and reduce negative effects on the environment, while at the same time satisfying a need for mobility. These measures are aiming to completely decarbonize road transport. With an average of 1.7 car per person in Europe, public transport solutions such as buses currently represent a cleaner option. Nevertheless, major changes cannot be achieved through incremental improvements to existing vehicles. Furthermore, buses are not the most desirable alternative since they do not fulfil mobility needs at a level as cars do. In order to meet its climate goals, the EU needs to accelerate the shift to electro-mobility.

On the contrary, individual passengers and airline companies are investing in carbon reduction projects to neutralize their proportion of carbon emissions produced during the flights. The airline companies spend billions of euros annually on carbon offsetting programs and charge customers per flight, to invest in environmental projects. This offsetting scheme, although good for the environment, has no impact whatsoever on the person that flies and this is why this concept is failing since uptake from passengers is less than 1%, according to BBC. Currently, neither airlines nor passengers are not obliged to contribute to the CO<sub>2</sub> offsetting, however starting from 2021 a new Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) will be in force. International Civil Aviation Organization (ICAO), the UN specialized agency, will coordinate the implementation of CORSIA.

Member states who volunteer to be part of a CORSIA pilot project starting from 2021 will be monitored for their carbon emissions which will have to be offset according to the specific formula. The offsetting will become mandatory for CO<sub>2</sub> emissions exceeding the baseline CO<sub>2</sub> level as presented in the Photo 9 below.



Therefore, the Green Mobility platform represents a blockchain based loyalty program, the cornerstone is offsetting and reducing CO<sub>2</sub> emissions in on-ground transportation. Its focus is on the transportation sector, with a clear aim to combine both ground and air forms of transport. Our goal is to offer airline companies an offsetting mechanism which will stimulate climate neutral road transportation by cooperating with relevant stakeholders (Uber, CarGo, Didi etc.). The platform will create a unique value chain which will enable airlines to offer a door to door service (end to end service) to its passengers at no extra cost.

Since airline companies offset their CO<sub>2</sub> emissions on the Carbon Credit Exchange and as demand for air travel rises and varieties of road transport opportunities appear, Green Mobility Platform will stimulate the usage of eco-friendly vehicles (electric, hybrid) for road transportation.

## 4.1. Case Example

The Green Mobility pilot project will take place on a trip between Zurich and Vienna. It is an ideal opportunity to unfold the process in the two of Europe's most known cities for their green practice. Around one million passengers annually fly from Vienna International Airport to Zurich Airport, and in the other direction, we have around 500.000 passengers flying from Zurich to Vienna. Each passenger travelling from the city center to the airport and vice versa spends approximately 35 euros in one direction for the airport transfer using taxis or other service providers (such as Uber, Car: GO etc.). During this ride, each car emits roughly 2.68 kg CO<sub>2</sub> (120g CO<sub>2</sub>/k). On the other hand, a return flight from Zurich and Vienna (which is approximately 1200 km) the aircraft emits 0,324t CO<sub>2</sub> per passenger (number received using MyClimate Calculator). The offsetting cost for an airline company conducting this flight is approximately 8 euros per passenger.

By using Green Mobility platform, our goal is to encourage airline companies to direct their offsetting expenditures (8 euros for example) to promote climate neutral on-ground transportation and extend their service by offering their passengers a door to door service booked in advance. With an incentive for their users, vouchers with approximately 20%-50% discounts and green miles which could be gathered and used afterwards, the Green Mobility platform creates a value chain which benefits all the stakeholders and contributes to Carbon Neutral Economy.

### OFFSETTING POSSIBILITIES



## 4.1. Unfolding the process

The process will be described from the user's point of view. There is a need from Airline companies to offer the so-called "door to door" service. While booking their ticket on the website of the prospective airline company, the users will be offered to use a discount voucher (for usage of electric cars only!) for their transportation from home to the airport, and from airport to their accommodation, with the opportunity to use the code in their return trip again. Upon the usage of the platform customers will join the Green Miles loyalty programs. The Green Mobility Platform will serve as an intermediary in creating those value chains and enabling the affairs to proceed as planned. The process will consist of several steps:

- Booking an airline ticket;
- Receiving the discount voucher;
- Opening the road transportation app (Car: Go, Uber etc.);
- Placing the code from the voucher;
- Ordering an electric vehicle;
- Getting to the airport;
- Landing;
- Using again the road transportation app;
- Getting to the desired location;
- Gathering Green miles;
- Optional – repeating the process in the return trip.



## 4.3. Technology Blockchain

With so many entities and value chains involved Blockchain technology represents a perfect solution for Green Mobility platform. It enables the creation of new digital relationships with its tools for authentication and authorization. Moreover, as IBM published the blockchain technology offers many benefits, but five most important are:

1. Better Transparency
2. Improved Security
3. Improved Traceability
4. Increased Efficiency and Speed
5. Reduced Costs

Using this technology will create an “automation” of trust between the entities and serve as a guaranty during the application usage, benefiting everyone on the platform.





## 4.4. Benefits - Green Mobility platform

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The Green Mobility Platform offers a vast number of benefits to its stakeholders:

- **Airline Companies**

Financially, airline companies are not benefiting, but there are other advantages for them. In their portfolio, they will finally have the offer of the end to end service (door to door) with an opportunity to increase the pool of rewards in their loyalty programs. Contribution to carbon-neutral road transportation. Maintaining a good public picture.

- **Service providers**

Car: Go, Uber and other software companies will not only improve their economic condition by having more passengers and rides. Additionally, more usage of electric vehicles will contribute to raising the awareness of environmentally friendly activities and the need to curb down the emissions on on-ground transportation.

- **Car manufacturers**

Meeting zero emissions criteria. Increased electric vehicles productions and sales. Carbon credits surplus which could be used for other purposes.

- **Customers**

Opportunity to have reduced price while using the transport applications. Access to loyalty program, which will provide certain benefits after every green ride. Additionally, raising environmental awareness and contributing to CO2 reduction.

# GREEN MOBILITY BENEFITS

How Green mobility helps pollution reduction



## PASSENGERS

- Discounted ride price
- Environmental awareness
- Access to loyalty program benefits for every green ride



## RIDE SHARING PROVIDER

- Increased profit
- Increased number of app users
- Attracting environmentally
- Focused customers
- Increase in loyalty program



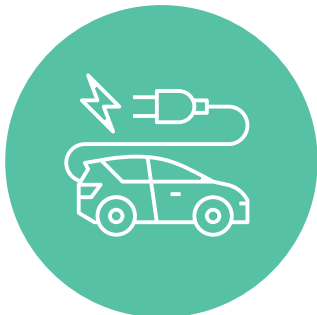
## FLEET/CAR OWNER

- Deliver more rides(stimulated demand for eCars)
- Save on gov't subsidies for a car/fleet
- Increased earnings



## AIRLINE COMPANIES

- Offsetting as a cost saving opportunity
- Door-to-door service
- Attracting environmentally focused customers
- Increasing the pool of benefits in their loyalty platform



## CAR MANUFACTURERS

- Meeting zero-emission vehicle credits criteria
- Increased electric vehicle production and sales
- Carbon credits surplus



## ENVIRONMENT

- Reduction in carbon emission
- Green mobility promotion
- Attracting environmentally
- Climate change slow down