



Environmental, traffic risk and social assessment of transport modal share in Bogotá, Colombia

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Bogota City



Located at 2600 m high, it counts over **7 million inhabitants**.

The city is home to over **2 million passenger vehicles**, responsible for some of the highest pollution levels in the world.

Bogotá ranks fourth among the world's capitals with the worst air quality.

Different Transport Modes



Bogota (Colombia) vs. Santiago (Chile)

Private cars



Taxis



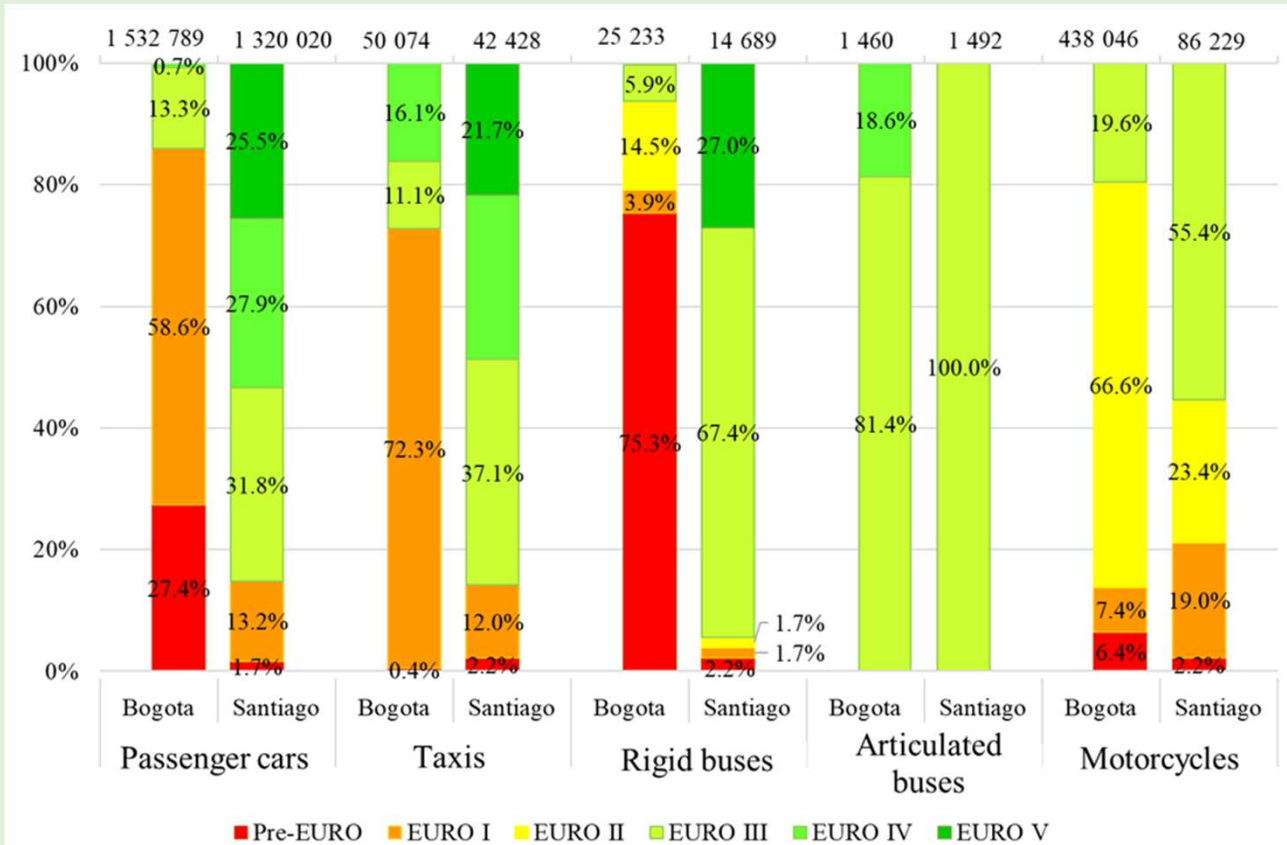
Motorcycles



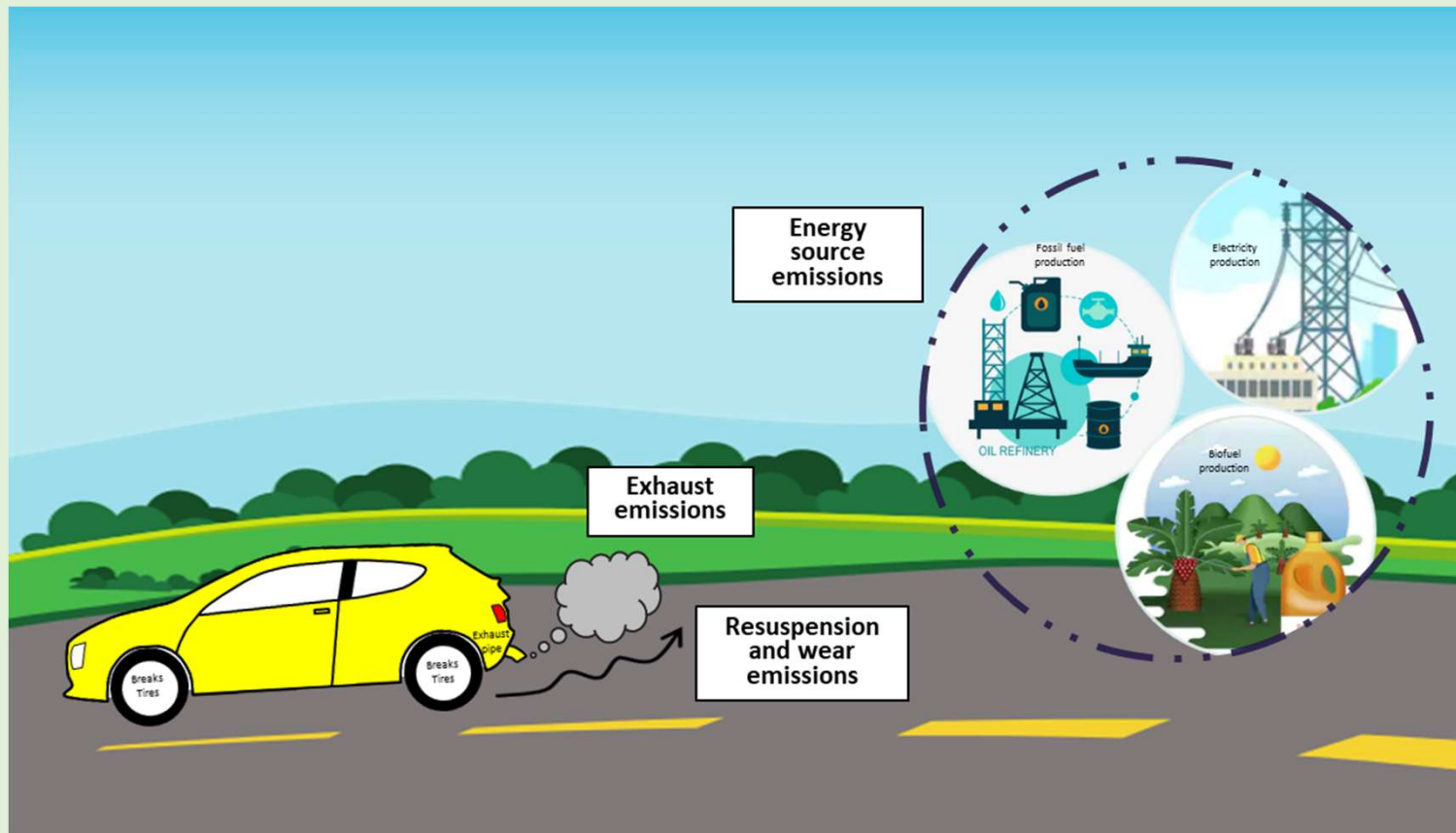
Rigid buses



Articulated buses



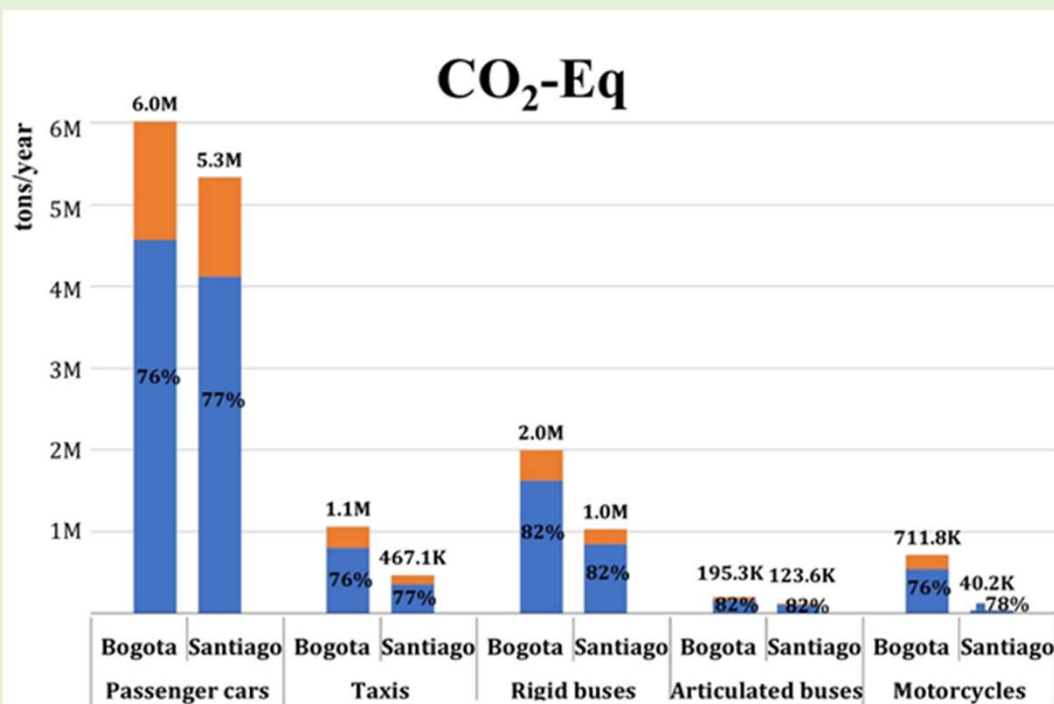
Well to Wheel Emission Inventory



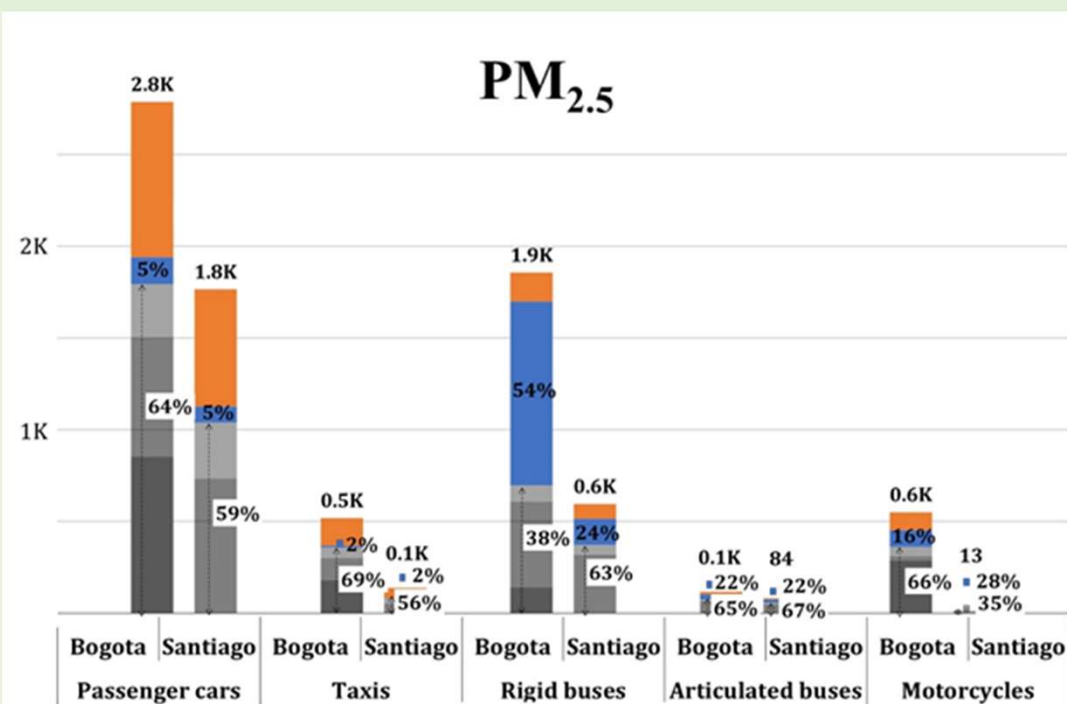
Well to Wheel Emission Inventory



Bogota (Colombia) vs. Santiago (Chile)



■ Direct emissions - Exhaust
■ Indirect emissions



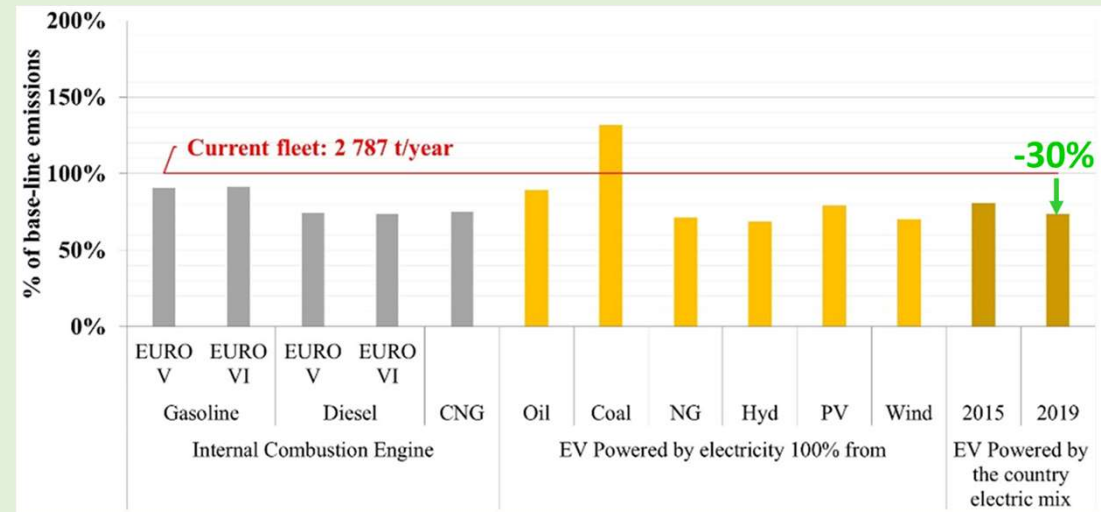
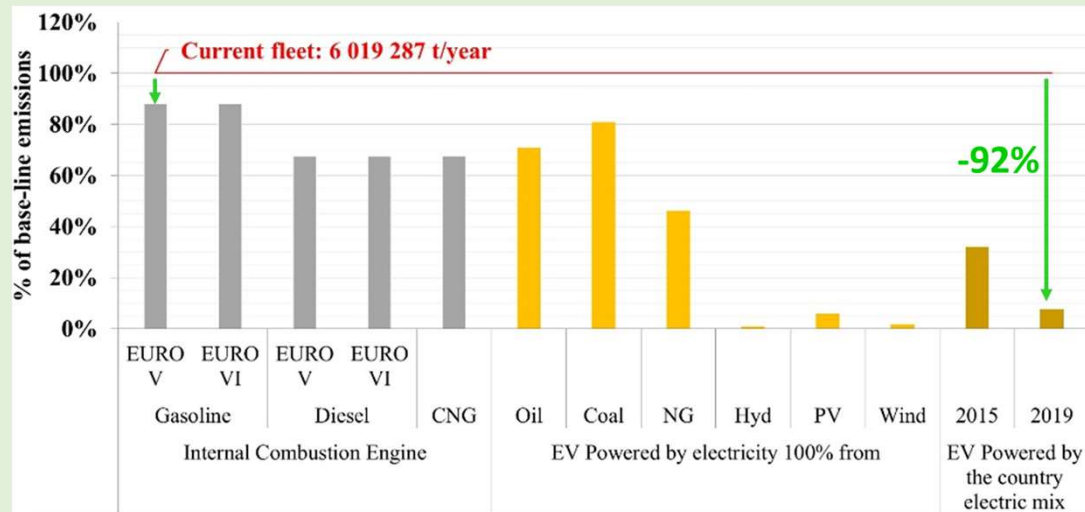
■ Direct emissions - Wear
■ Direct emissions - Paved resuspension
■ Direct emissions - Unpaved resuspension
■ Direct emissions - Exhaust

Effects of a Change in Technology



Private cars : CO₂-eq

Private cars : PM_{2.5}



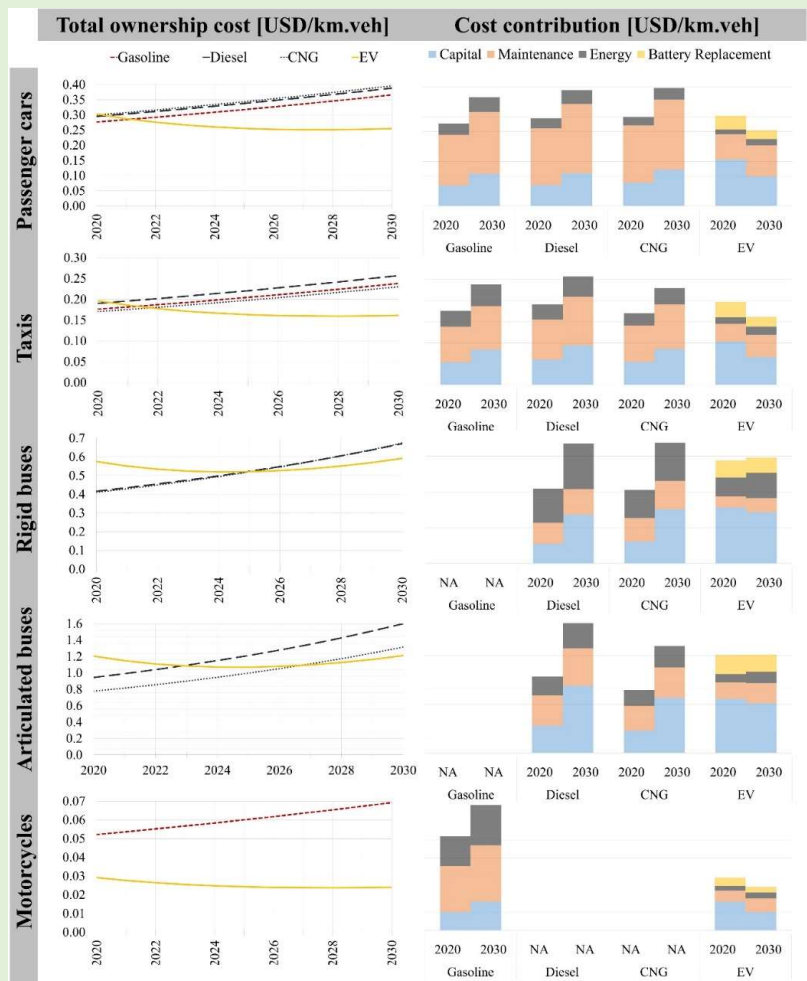
ICV vehicles

EV vehicles

ICV vehicles

EV vehicles

Attractiveness of Technologies



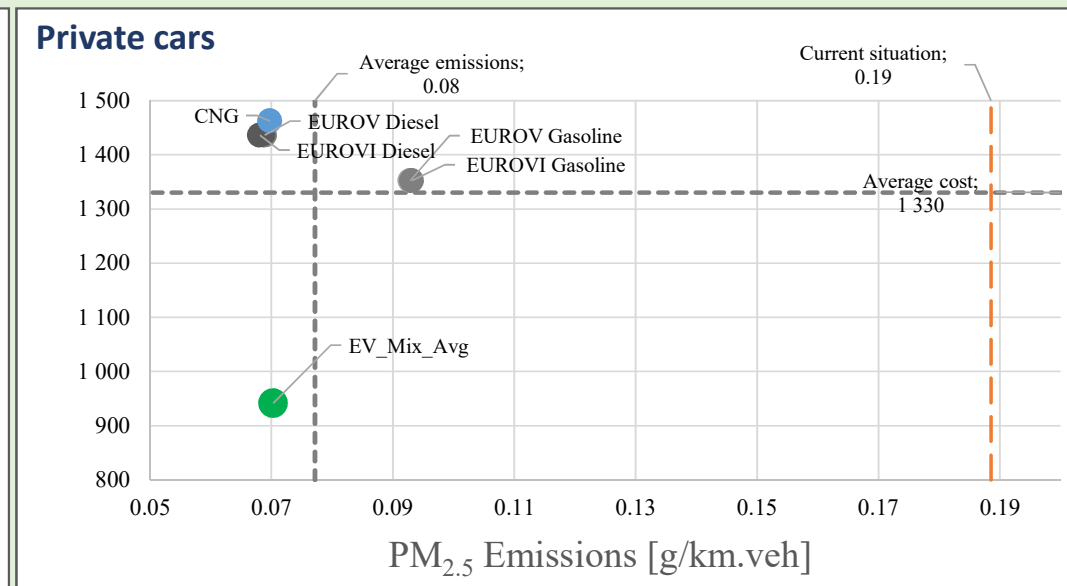
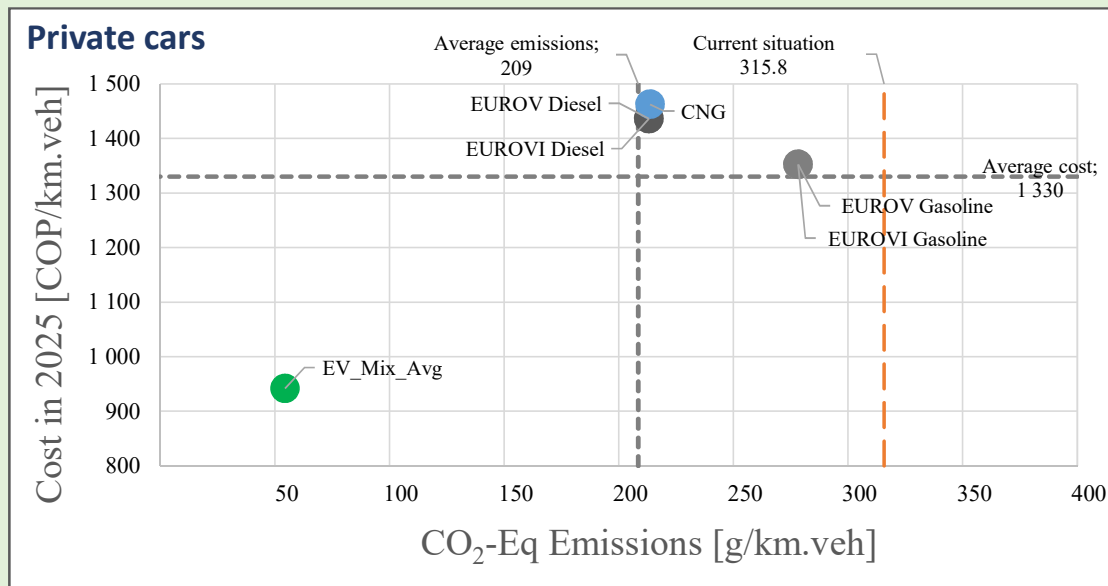
Despite a cost which is already low, the fraction of electric car in Bogota is still very low. That can be due to a number of barrier which prevents a faster renewal:

- ✓ The **capital cost** of an electric car is currently significantly higher than for a conventional car.
- ✓ The **refueling time** of an electric car is much higher than for a conventional car
- ✓ The **autonomy** of electric cars is still significantly lower than for a conventional car
- ✓ The **charging stations** are still scares and difficult to find in Bogota and more generally in Colombia

Attractiveness of Technologies



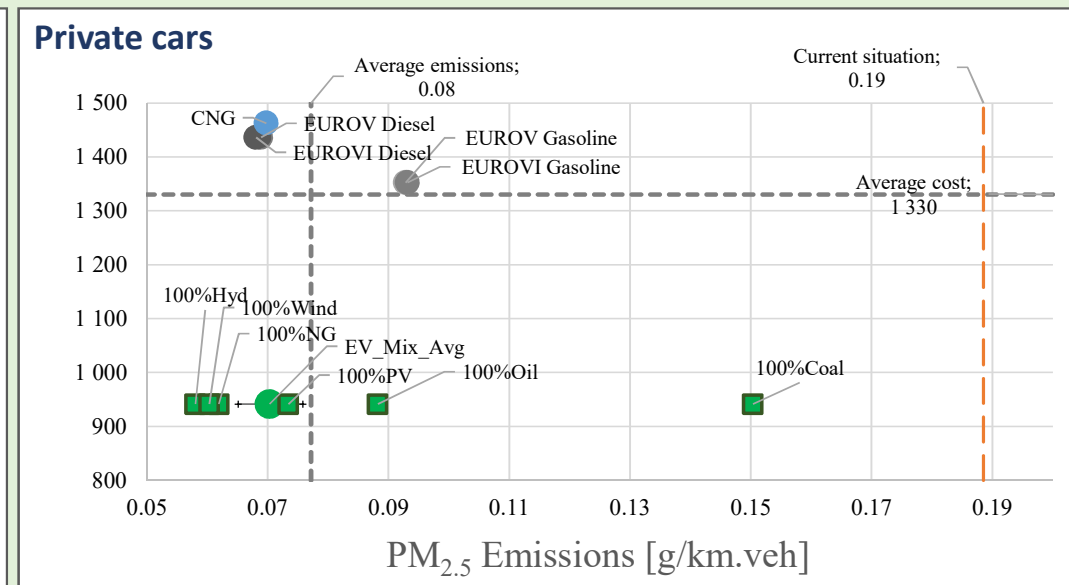
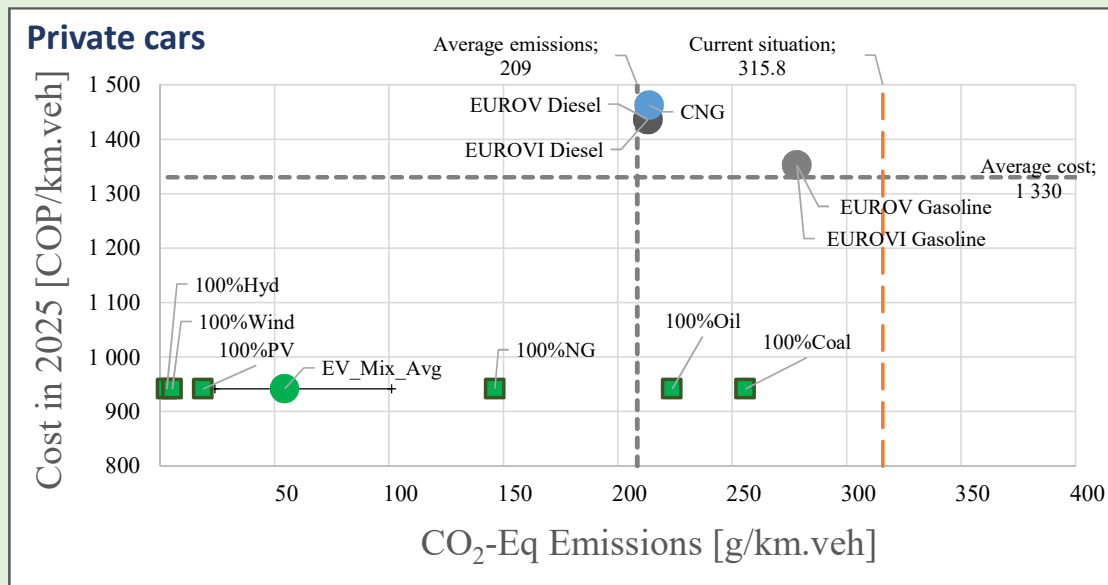
The introduction of electric cars will lead to a decrease in CO₂ emissions, but not in PM_{2.5}.



Attractiveness of Technologies



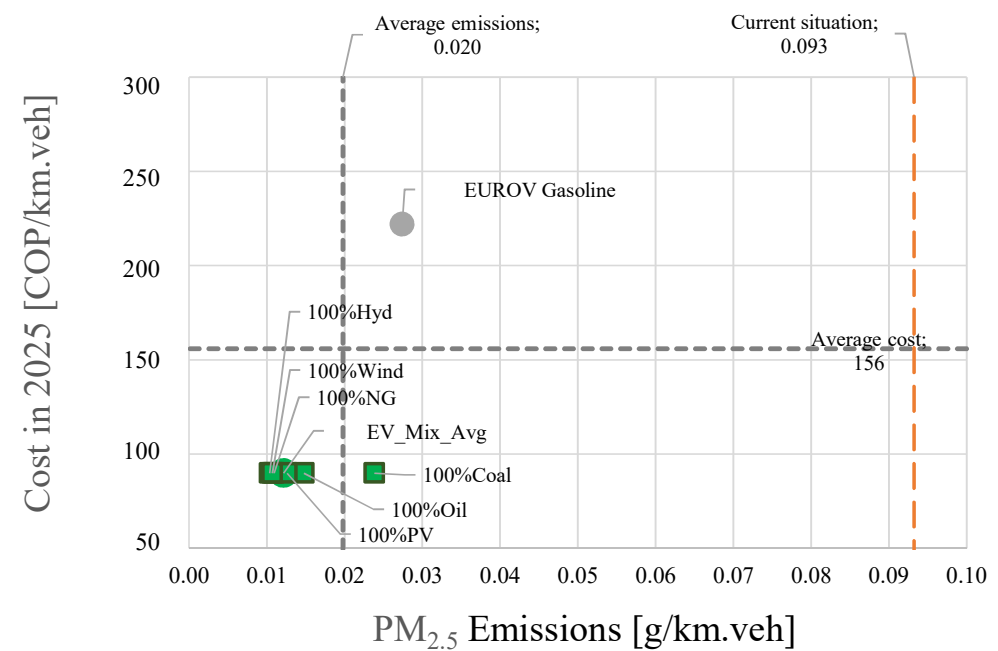
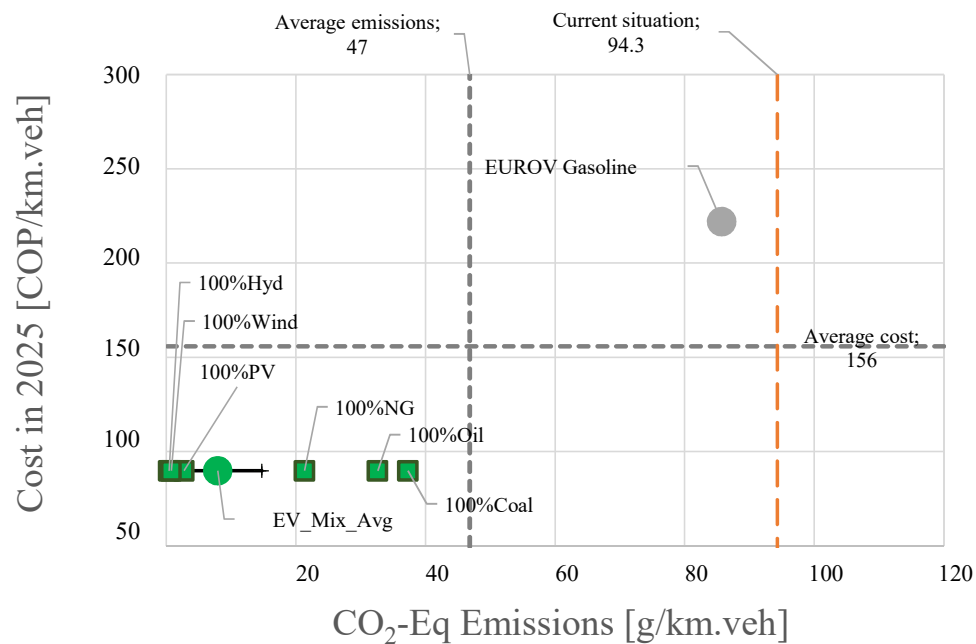
Emissions resulting from the use of electric vehicles depend on the electricity generation mix.



Attractiveness of Technologies



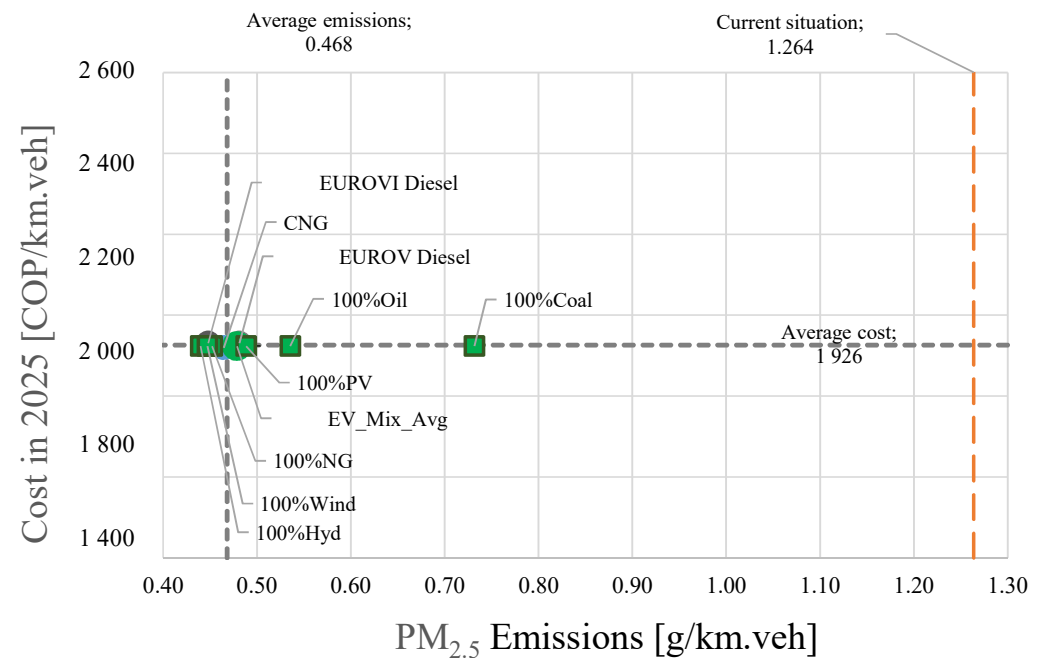
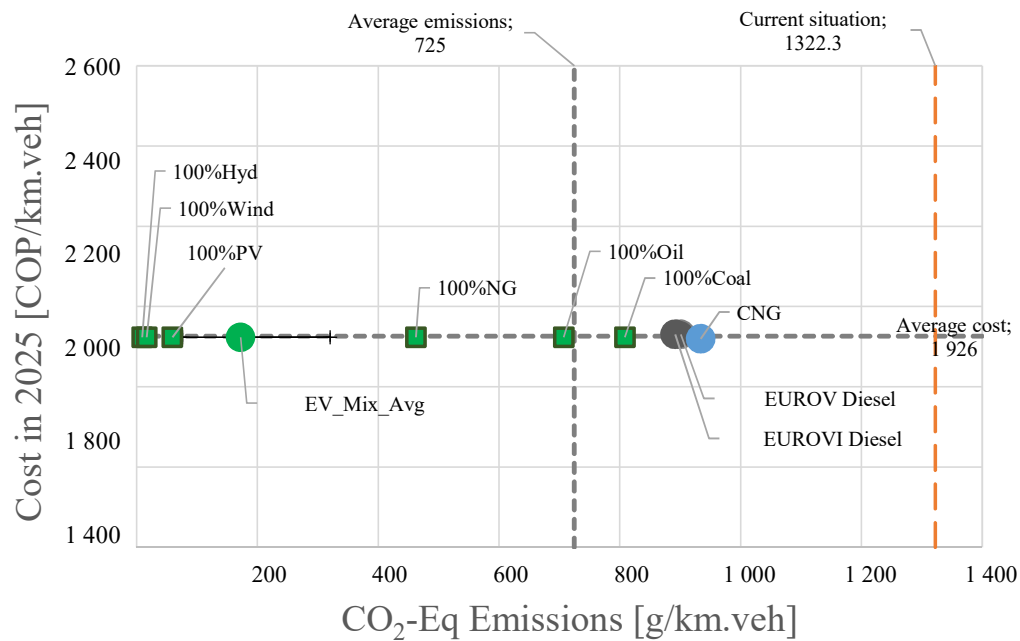
Electric motorcycles are cheaper and will reduce CO₂ and PM emissions of more than a factor 2



Attractiveness of Technologies



In 2025, electric rigid buses are still not cheaper, they reduce CO2 emissions but not PM emissions



Effect of Electrification on Energy Demand



With electric vehicles the energy demand will decrease but the electricity demand will increase

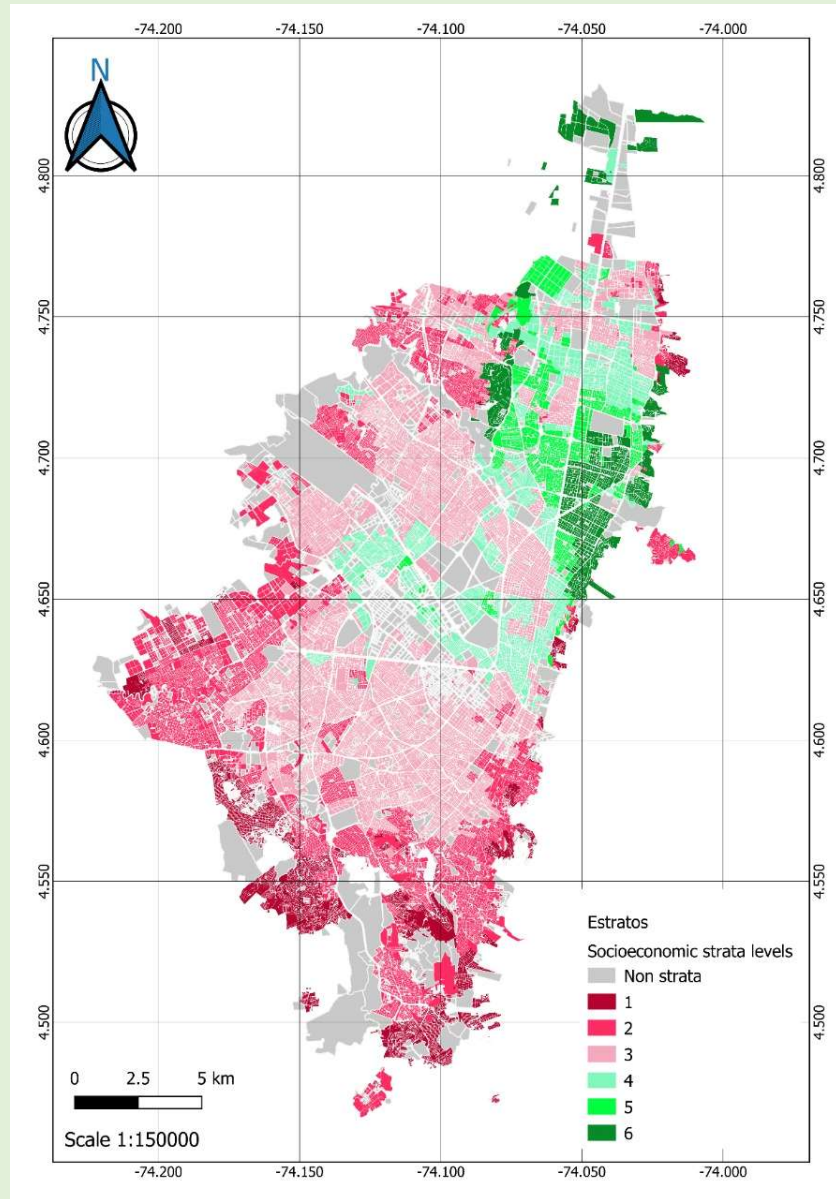
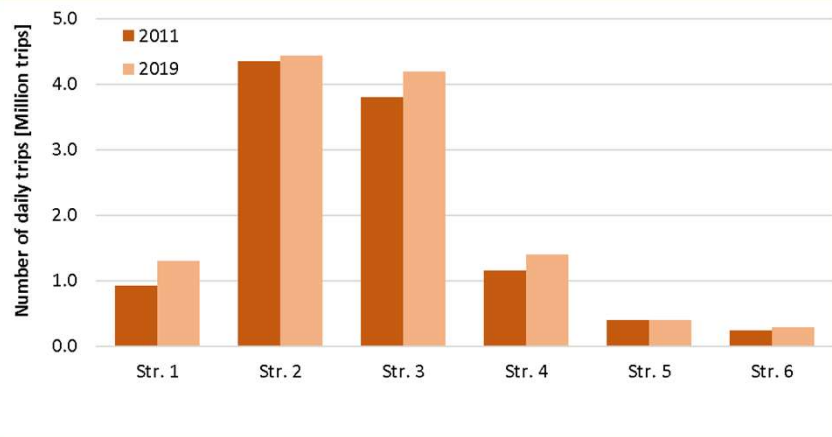
Energy used [GWh]	Passenger cars	Taxis	Rigid buses	Articu. buses	Motorcycles
by the current vehicle fleet	17 440	3 335	3 611	600	2 000
by electric vehicles	4 011	767	975	126	220
Energy reductions	77%	77%	73%	79%	89%

Current energy consumption in Bogota: 10 398 GWh/yr

Increase of electric consumption due to electric vehicles (%)	
Passenger car	39%
Passenger cars + Taxis + Moto	48%
All passenger vehicles	59%

Bogota's Stratas

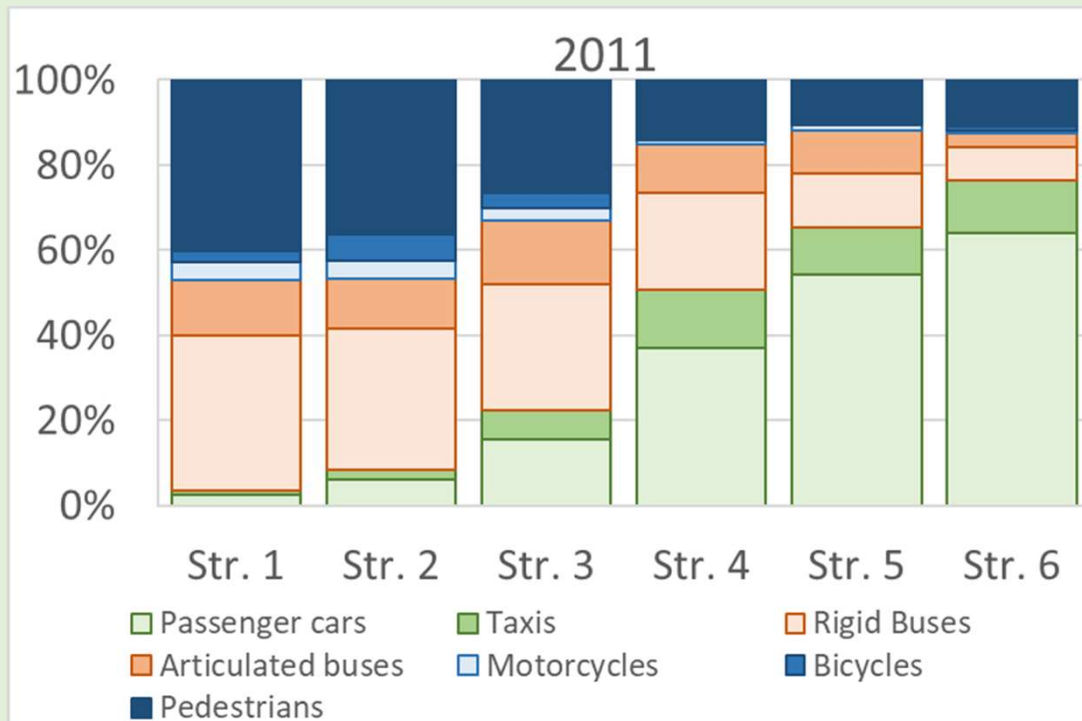
Strata location



Stratas and Transport Modes



Repartition in the percentage of the daily trips per capita between the different transport modes



Richer stratas use more private cars and taxis

The poorest stratas make greater use of rigid buses and motorcycles, and are more likely to travel on foot.

Stratas and Environmental, Risk, Social Impacts



Dimensionless values of indicators associated to the different transport modes



Indicators

Environmental : CO₂-eq, PM_{2.5} emissions and energy consumption per trip

Safety-related risk : total deaths per trip and total injuries per trip

Social : traffic congestion capacity, travel time per trip, feeling of discomfort

Cars are the worst for environment and congestion

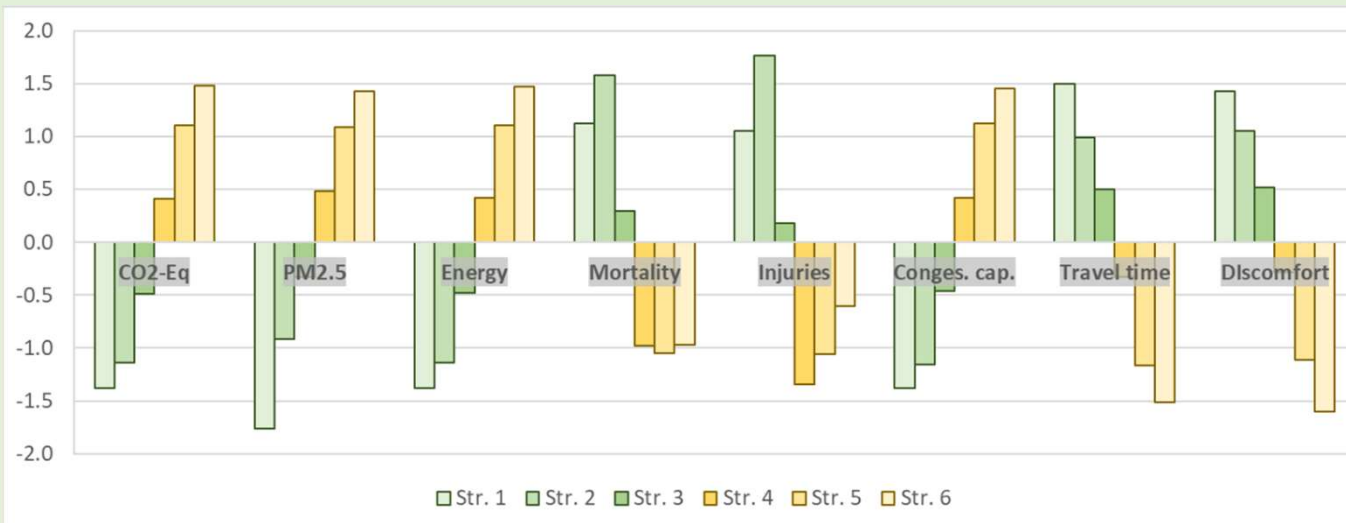
Motorcycles are the worst for safety

Buses are the worst for travel time and discomfort

Stratas and Environmental, Risk, Social Impacts



Indicator deviations for the different transport modes by strata



Richer stratas

- ✓ have more impacts on environment and traffic congestion,
- ✓ take less risk,
- ✓ travel faster and are satisfied with the transport mode they use.

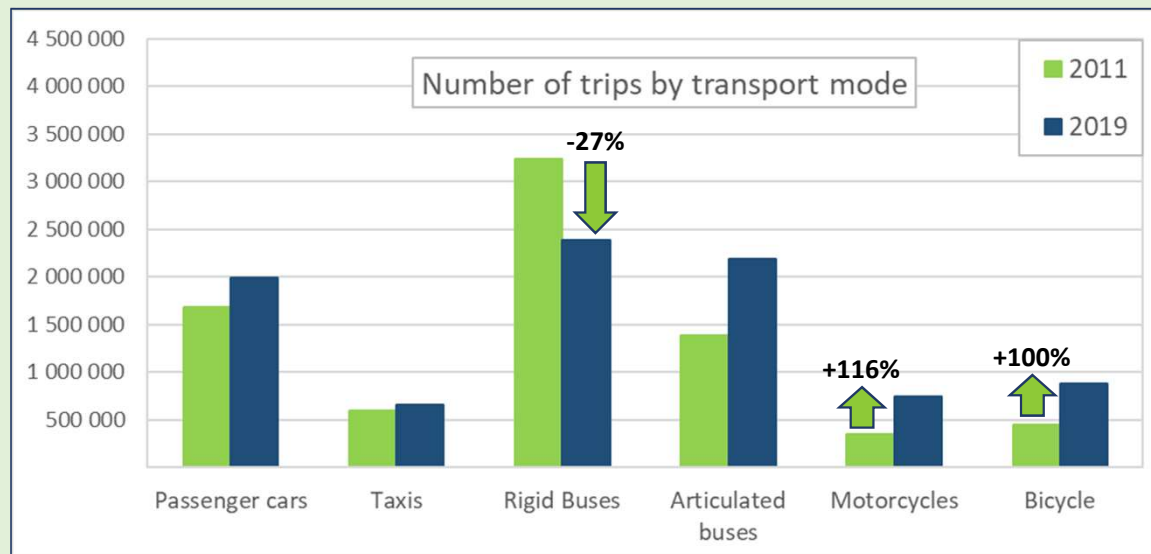
Poorest stratas

- ✓ have less impacts on environment and are traffic congestion,
- ✓ they take more risk,
- ✓ take more time to travel and are less satisfied with the transport mode they use.

Trends



Trends of the repartition between the different transport modes.



Trends



Trend between 2011 and 2019 for transport modes and socioeconomic strata



Rigid buses is increasing while **articulated buses, bicycles and motorcycles** increase.

Cars increase for poorest stratas while it increase for richest stratas, it is the opposite for the **pedestrians**.

Transport mode choices are motivated differently in different strata



Obrigado pela vossa atenção !