Vehicles powered by internal combustion engines emit carbon dioxide (CO_2) due to the burning of fuel in their motors. The following general formula can be used to quantify these emissions:

$$E = A * EF$$

Considering:

***E** = Total mass of CO_2 emitted from vehicle exhaust in one year* $\left[\frac{kt_{CO_2}}{year}\right]$

***A** = Activity rate expressed in liters of fuel consumed by vehicles in one year* $\left[\frac{L_{fuel}}{year}\right]$

***EF** = Emission factor related to the fuel applied* $\left[\frac{kt_{CO_2}}{L_{fuel}}\right]$

Considering a public transport city fleet by diesel-powered buses that hold three medium-sized categories of vehicles in operation (mini, standard, and articulated), the annual fuel consumption (activity rate - A) can be estimated from: the number of buses by category; the diesel consumption factor for each size of vehicle; and the mileage (km) traveled per vehicle, accordingly to the equation below.

$$A = \frac{L_{diesel}}{year} = \left[Fleet_{mini} * \frac{\frac{km}{year}}{bus} * \left(\frac{L_{diesel}}{km}\right)_{mini}\right] + \left[Fleet_{padron} * \frac{\frac{km}{year}}{bus} * \left(\frac{L_{diesel}}{km}\right)_{padron}\right] + \left[Fleet_{articulated} * \frac{\frac{km}{year}}{bus} * \left(\frac{L_{diesel}}{km}\right)_{articulated}\right]$$

Fleet and mileage data specific to several Latin American cities are used to perform these calculations accordingly to different references. The emission factors (EF) and diesel consumption (L_{diesel} / km) are equivalent for all cities and shown in the next table as well as their information sources.

Factor	***Value***	***Source***
Consumption factor for midi e-buses	*0.35 [L_{diesel} / km]*	*SPTrans*
Consumption factor for standard e-buses	*0.50 [L_{diesel} / km]*	*SPTrans*
Consumption factor for articulated e-buses	*0.75 [L_{diesel} / km]*	*SPTrans*
CO2 emission factor (EF)	*2.6E-6 [$ktCO_2$ / L_{diesel}]*	*IPCC*

Instead of accounting for emissions from diesel buses, the platform presents emissions avoided regarding the use of zero-emission technologies. Following the steps explained before, we calculated the intensity of pollution generated if the entire fleet of zero-emission vehicles were composed of diesel vehicles.

Finally, it is essential to remark that the CO_2 factor (EF) we adopted only considers the emissions that occur directly in the vehicle's exhaust. They refer commonly to as **tank-to-wheel** emissions; that is, the emission from the burning

of the fuel stored in the **tank** of a bus. This burning enables the transfer of energy to the vehicle's **wheels**, thus generating movement.

It is necessary to estimate all emissions that happen during the life cycle of the technology or source in question to quantify the actual carbon intensity of a vehicle technology or an energy source – i.e., from the extraction of natural resources, through the production processes and the transport, until final consumption on a bus. They are commonly known as **well-to-wheel emissions** since they take into account all the CO_2 generated from the beginning of the extraction/production **(well)** until the total consumption **(wheel)** of a given resource.

The production processes can vary considerably according to different locations, technologies, or raw materials used; because of that, emission factors (EF) from the well-to-the-wheel tend to hold a considerable level of uncertainty and variability. In the present version of the platform, we present only the emissions related to the portion of the **tank-to-wheel** since we have not consolidated yet information about emission factors from the **well-to-tank**.