

Creating job opportunities with la Rollita electric buses in Bogotá

Benefits Assessment - Preliminary results

September 2023 - Reading time: 4 min

Bogotá is training women to join the workforce as e-bus drivers, promoting inclusive good, green jobs and strengthening the city's just and green transition.

La Rolita is Bogotá's pioneering public transportation provider, with a fully electric fleet of 195 buses across 11 routes and 35,000 users. Over half of the operators are women, ensuring equal opportunities for them in a predominantly male-dominated sector. Through La Rolita programme, Bogotá is training groups of women to become e-bus drivers.

The following report outlines the initial impacts of La Rolita and its scale up potential, using data accessible as of September 2023.

Improving gender equality, saving emissions and providing better service

In a context of rapid urban growth in the last few years, Bogotá has made significant investments in public transport, to meet the needs of its 8 million residents. The city is rethinking its transportation by enhancing street access and safety, expanding its cycling and pedestrian networks, reimagining active mobility of kids on their way to school, and improving public transport.



Air pollution is responsible for around 2,800 premature deaths in Bogota each year.



43% of GHG emissions come from the transport sector in Bogota

The city's road transport sector is still the greatest contributor to greenhouse gas (GHG) emissions, accounting for 43% of Bogotá's total GHG emissions and a significant portion of air pollution. Transitioning to electric mobility is an important step to effectively tackle air pollution as vehicles emit harmful pollutants. These pollutants can penetrate deep into the lungs and are linked to respiratory and cardiovascular morbidity and mortality, even at low concentrations.

Vulnerable groups such as children, pregnant women and the elderly, and individuals with pre-existing heart and lung disease, are particularly affected. In 2023, it's estimated that Bogotá's air pollution has caused around 2,800 premature deaths, with a significant contribution from the public transport sector.

From la Rolita buses...

Meanwhile, La Rolita emerges as a promising initiative aimed at improving Bogotá's air quality, environmental footprint and social impact. Within the a year of operation, this woman-led public transport operator has successfully integrated 195 electric buses into its fleet, serving over 35,000 people on 11 lines in low income residential neighbourhoods. While bus operations are a mainly male-dominated sector, La Rolita programme is training groups of women to become e-bus drivers, opening new opportunities in the sector and changing perceptions of what mass transit can look like.

Traditional buses emit both particles coming from the combustion of their engine, and from the wear of brakes and tyres on the road. Electric buses do not have an internal combustion engine, which reduces PM_{2.5} operations emissions by 59%, and NO_x emissions by 100%. This reduces the air pollution for the city residents, while reducing greenhouse gas emissions.

The preliminary analysis estimated that the 195 La Rolita buses have:

Reduced 59% of buses PM_{2.5} emissions



Compared to their diesel equivalent, the project reduces 0.46 tonnes of PM_{2.5} (59%) and avoids 54 tonnes of NO_x emissions (100%) per year.

Avoided 8,580 t CO₂ emissions per year



The 195 electric buses avoid 8,580 tonnes of CO₂ emissions per year, compared to their diesel counterparts. **Over 20 years, this represents 171,630 tonnes of CO₂ emissions avoided, the equivalent of 1.5% of Bogotá's total emissions.**

Reached 56% of women employed in the workforce




As of September 2023, la Rolita's workforce was employing 56% of women across the bus operators, maintenance of buses and its administration. This includes 277 female bus drivers.

... to the impact of the city commitment of procuring 1,479 electric buses across the city:


The city recently procured 1,479 electric buses to complement the rest of the city fleet. Those buses, compared to their diesel equivalent, could:

Reduce 346t of buses NOx emissions




Compared to their diesel equivalent, the project would save 2.6 tonnes of PM_{2.5} and 346 tonnes of NO_x emissions per year.

Avoid 52,750 t CO2 emissions per year



Scaling up electric buses to the whole city could avoid 52,750 tonnes of CO₂ emissions per year compared to their diesel counterparts.


Prevent 3 premature deaths per year



The reduction in air pollution from electrifying Bogota's public transport system could avoid 3 premature deaths per year.

If the city was electrifying all the operating buses, this would:


Reduce 3,560 t of buses NOx emissions



Compared to their diesel equivalent, the project would save 16.4 tonnes of PM_{2.5} and 2,175 tonnes of NO_x emissions per year.

This translates into a reduction of the total city PM_{2.5} concentration by 1% (0.2 µg/m³).


Avoid 363,640 t CO2 emissions per year



Scaling up electric buses to the whole city would avoid the emission of 363,640 tonnes of CO₂ per year compared to their diesel counterparts.

This is equivalent to 3.2% of the city yearly total emissions.

Prevent 21 premature deaths per year



The reduction in air pollution from electrifying Bogota's public transport system would avoid 21 premature deaths per year.

This would also reduce cases of lung cancer and asthma in the city.



References & Methodology

This report shows the preliminary impacts of the project, based on the data available in August 2023.

References:

- ¹ C40, Bogota inventory (2020): https://www.c40knowledgehub.org/s/article/C40-cities-green-house-gas-emissions-interactive-dashboard?-language=en_US
- ² ITDP, Bogotá, Colombia's Approach to Safe, Sustainable, and Accessible Transport (2023): <https://www.itdp.org/2023/05/08/bogota-colombias-safe-sustainable-accessible-transport/>
- ³ Bloomberg, Colombia's Women-Led Electric Bus Fleet: <https://www.youtube.com/watch?v=ns-jpNKqyC1s>
- ⁴ Medellín cómo Vamos (March 2023). <https://www.Medellin.comovamos.org/en-Medellin-se-recupera-el-empleo-pero-los-jovenes-se-quedan-atras>

Data

- Vehicle Kilometers Travelled (VKT) from La Rolita [spreadsheet provided by the city]: VKT from La Rolita buses from February to July 2023
- [Buses del Sistema Integrado de Transporte Público en Operación, Datos Abiertos Bogota](#) [link to download, from June/2023]: all vehicles from the city public transport, with information on type of vehicle, fuel and euro standard;
- [GTFS data, Datos Abiertos Bogota](#) [link to download, from June/2023: General Transit Feed Specification from Bogota.

Vehicles Kilometers Travelled (VKT)

To calculate the scenarios impact, we need to compare the project measures (La Rolita buses, or all present electric buses, or all fleet electric buses) to business as usual (BAU) scenarios where those actions would not happen.

La Rolita scenario:

- **Total VKT:** provided by the city,
- **% of VKT by vehicle type, fuel and euro standard:** for the BAU, we assumed the fleet to 100% standard diesel buses Euro 4. For the project, we assumed La Rolita buses are 100% standard electric buses, per city.

1,479 electric buses scenario:

- **Total VKT:** calculated based on Bogota's GTFS, and won't change between the scenarios
- **% of VKT by vehicle type, fuel and euro standard:** for the BAU we calculated from vehicles database. We took the present electric vehicle

proportion in the city by vehicle type and distribute it to the other vehicle types and euro composition, resulting in zero electric vehicles in the city.

- **% of VKT by vehicle type, fuel and euro standard:** for the project, we assumed the vehicle proportion in the city by type, fuel and euro to be the VKT proportion;

Scale up scenario:

- **Total VKT:** calculated based on Bogota's GTFS, and won't change between the scenarios
- **% of VKT by vehicle type, fuel and euro standard:** for the BAU we calculated from vehicles database, and we assumed the vehicle proportion in the city by type, fuel and euro to be the VKT proportion;
- **% of VKT by vehicle type, fuel and euro standard:** for the Project: we consider all electric vehicles.

GHG and Air pollution modelling

- The AQUA Transport tool was applied to calculate the air pollution and GHG emissions from the public transport sector, for each one of the scenarios. The savings in GHG and air pollution were calculated by subtracting the Project emissions from the BAU emissions.
- For air pollutants (NOx, PM2.5), we used emission factors from the [EMEP/EEA \(2019\)](#) emission factors database to calculate the emissions.
- For GHG, we used energy consumption from the [EMEP/EEA \(2019\)](#) for CNG vehicles and this [ICCT study](#) from Sao Paulo values (average from values in page 16 of the document) for electric/diesel vehicles. The vehicles used in the Sao Paulo study may better represent the type of electric vehicles used in Bogota. The emission factors are from ICCT (2009).
- We applied the Colombian grid emission factor (0.000126 ton CO2e/ kwh) from the [Mienergía from Colombia](#).
- We then used the C40 AQUA tool to calculate the air pollution concentration and the health impacts (deaths avoided and YLL) related to La Rolita, present electric buses, and scale up scenarios.

Health modelling

Health modelling is using C40 AQUA tool (2023). The baseline health is coming from Global Burden of Disease study (2019) for Colombia, and Oxford Economics disaggregation per age group.

Air Quality baseline in the city is 16.6 ug/m³, coming from Van Donkelaar et al at George Washington University - for the year 2021.

Limitations

GTFS represents only the formal public transport for Bogota, not including any informal type of public transportation that may be significant in the city; We calculated vehicle proportions from Bogota and assumed the VKT proportion to follow this vehicle proportion. In reality, we can expect that some type of vehicles may have a higher/smaller VKT than others;

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