Bogotá's zero emission vehicle and operational models

The city is implementing four operations models to assess the performance of zero-emission vehicles for last-mile distribution in different city zones with challenges of air quality and GHG emission reduction.

### Colombia

**Bogotá DC, Cundinamarca**

- **1.775 km²** Total Area
- **7.834.167** Estimated Population in 2022
- **$28.5 billion COP** Municipal Budget

This project generated relevant information for decision-makers on which type of vehicle is best suited for different operational and geographic conditions. Therefore, it showed areas of the city in which electric vehicles are efficient for freight and distribution operations.

The analysis of the four models as a whole allows a comparative evaluation between different types of vehicles under different geographic and operational conditions.

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#### Model 1

- **Power:** 60 kW / 40 HP
- **Autonomy:** 230 km (in optimal conditions)
- **Performance:** 6.0 km / kWh
- **Capacity:** 1,000 kg
- **Freight generator:** Comercial Nutresa
- **Vehicle supplier:** Transportempo
- **59 days of operation**

Pilot from Sep 27 to Dec 30, 2022

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#### Model 2

- **Power:** 750 W (Nominal) – Limited 500 W
- **Loading time:** 4 to 6 hours
- **Performance:** 25 km per battery charge
- **Payload:** 250 kg (not including the driver)
- **Freight generator:** Comercial Nutresa
- **Vehicle supplier:** Lola Te Mueve
- **Logistic Operator:** Líder Aliado
- **25 days of operation of two e-trikes**

Pilot from Oct 4 to Oct 29, 2022

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#### Model 3

- **Power:** 1,000 W
- **Autonomy:** 40 to 50 km
- **Payload:** 400 kg
- **Freight generator:** Quick
- **Vehicle supplier:** EcoTriciclos
- **25 days of operation**

Pilot from Nov 1 to Dec 30, 2022

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#### Model 4

- **Power:** 1,000 W
- **Autonomy:** 40 to 50 km
- **Payload:** 400 kg
- **Freight generator:** Taxis Verdes
- **Vehicle supplier:** EcoTriciclos
- **25 days of operation**

Pilot from Nov 1 to Dec 30, 2022

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Model 1, one diesel combustion truck, was replaced by one electric van, delivering packaged food throughout the city from a distribution center in Puente Aranda, which is one of the city districts with air quality problems and high industrial activity.

Model 2, one gasoline-powered van was replaced by two electro-assisted tricycles delivering packaged food throughout an area that does not exceed a 3 km radius of operation.

Model 3, one gasoline-powered motor truck, was replaced by one electric three-wheeler distributing and collecting goods, mainly parcels.

Model 4, two gasoline-powered motorcycles were replaced by one electric three-wheeler, distributing medical devices in a specific area of operation. This model allows assessing the possible trade-offs between electric vehicles with higher load capacity versus low autonomy ones.
### Results

#### Environmental Impact

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂-eq emissions per kilogram transported (kg CO₂ eq/kg)</td>
<td>0.049</td>
<td>0.002</td>
<td>0.006</td>
<td>0.003</td>
</tr>
<tr>
<td>CO₂-eq emissions per delivery (kg CO₂ eq/delivery)</td>
<td>3.3</td>
<td>0.005</td>
<td>0.182</td>
<td>0.111</td>
</tr>
</tbody>
</table>

#### Logistics Performance

<table>
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<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average kilograms of goods delivered per delivery (kg / km)</td>
<td>7</td>
<td>4</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Average distance traveled per hour in route (kg / hour)</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Average number of deliveries that a vehicle can accomplish per hour in route (deliveries / hour)</td>
<td>1</td>
<td>9</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Average number of deliveries a vehicle can accomplish per kilometer (total deliveries / km)</td>
<td>0.09</td>
<td>2.25</td>
<td>0.27</td>
<td>0.3</td>
</tr>
<tr>
<td>Average kilograms delivered per operating hour (kg / hour)</td>
<td>65</td>
<td>18.3</td>
<td>62.2</td>
<td>195</td>
</tr>
</tbody>
</table>

#### Economic Impact

<table>
<thead>
<tr>
<th>Model</th>
<th>COP kg/km</th>
<th>USD kg/km</th>
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</thead>
<tbody>
<tr>
<td>Operation cost per month of zero or low-emission vehicles</td>
<td>$ 355,470</td>
<td>$ 74,100</td>
<td>Operation cost of transporting one kg of product per kilometer traveled in zero or low-emissions vehicles</td>
<td>$ 0,55</td>
<td>$ 0,00011</td>
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#### Social Impact

<table>
<thead>
<tr>
<th>Perception of the project direct beneficiaries (community, neighbours, shopkeepers, merchants, clients) around the areas of the project implementation</th>
<th>95% of citizens support the use of electric vehicles for last-mile distribution</th>
</tr>
</thead>
</table>

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<tr>
<th>Perception of satisfaction of drivers and employees of the freight companies/businesses involved in the project in the operation of zero-emission or low-emission vehicles</th>
<th>100% of the drivers are Satisfied or Very Satisfied with their work</th>
</tr>
</thead>
</table>

| 50% of the employees of the companies involved in the project are "Satisfied" or "Very Satisfied" with the pilot |

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* The results reported here were obtained on the dates on page 1 for each model and refer to the total number of operational days on which these models were performed.