Uncovering the pathway of decarbonization EcoLogistics cities

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FOREWORD

Urban freight contributes to 40 percent of CO_2 emissions related to urban transport, exacerbating air quality and climate change concerns. To address this issue, cities worldwide are devising strategies to revolutionize urban goods delivery and mitigate the environmental impact. EcoLogistics cities have taken the lead, implementing Low Carbon Action Plans for Urban Freight (LCAP-UF) and spearheading innovations to decarbonize the sector. EcoLogistics cities have explored various technologies, including electric vehicles, consolidation centers, and smart logistics systems, with the goal of reducing emissions, enhancing efficiency, and bolstering safety in the last-mile segment.

EcoLogistics revealed unique challenges faced by Latin American cities, including difficulties in adopting modern technologies, while India must focus on clean energy generation. Both regions demand investments, and these endeavors present opportunities for sustainable development. These regions offer immense potential for enhancing last-mile solutions. After EcoLogistics city assessments, cities were able to demostrate option in how to reduce their carbon footprint and enhance urban freight efficiency.

The shift toward a smart and efficient urban freight network necessitates a blend of technological solutions and tailored policy reforms to each city's context. Initiatives require an understanding of local dynamics, including infrastructure, regulations, economics, and social factors. The project revealed the need to establish universal indicators that allow cities to exchange knowledge and experiences with multiple stakeholders to better plan freight systems integrated into city infrastructures.

ICLEI Sustainable Mobility

INTRODUCTION

To uncover the decarbonization pathway follow by EcoLogistics cities in estimating the potential of the Low Carbon Action Plans for Urban Freight (LCAP-UF) and understand the remaining efforts required to reduce greenhouse gas (GHG) emissions by 2030. The exploratory analysis reveals that if fleet electrification were to be implemented today and all vehicles were to achieve zero emissions, the potential reduction in CO2e emissions would be over ten times greater compared to the worst-case scenarios were the adoption of clean technologies does not grow more than today trends. Furthermore, if the countries were to transition to largely decarbonized energy grids, the reduction could exceed 100 times.

The objective of this report is to uncover the projected emissions and decarbonization targets in EcoLogistics cities. The project focuses on evaluating the main indicators of urban freight in the participating towns, conducting an impact study of (GHG), and constructing future scenarios based on freight indicators. The cities have collected various metrics, including the number of trips, travel distance, load capacity, loading and unloading time, types of vehicles, and fuels used. This data enables the cities to reassess and develop new scenarios to achieve sustainable freight operations.

Participant cities and projects involved are as follows:

- **Rosario – Argentina:** *BiciPack Bicycles for sustainable logistics.*

- **Bogota – Colombia:** *Evaluation of deconsolidation alternatives in zero-emission vehicles for last-mile distribution of package.*

- **Kochi – India:** *Introducing electric loaders in prominent market centers and developing charging infrastructure.*

- **Shimla – India:** *Ongoing freight parking & loading zones.*

- **Panaji – India:** *Promoting collaborative last-mile delivery (load pooling) through electric freight vehicles.*

The following sections outline the methodology employed for scenario planning and provide references related to electricity adoption and emissions specific to each region. Subsequently, the process of scenario construction is described, encompassing three distinct scenarios.

The first scenario, labeled as "Do Nothing," involves an analysis of the current operations in the cities, comparing them with projected future demands. The second scenario, considered as the best-case scenario, assumes the immediate adoption of zero-emission technologies and a complete transition to fully electric fleets. Lastly, the third scenario represents the most probable outcome based on the current policies and master planning of the studied cities, considering the perspectives of local officials and policymakers in each region.

EcoLogistics: scenario planning methodology

The process begins by collecting various urban freight indicators, including traffic flow, delivery times, and customer satisfaction, to identify areas that require improvement. This data-driven approach enables municipalities and their partners to make informed decisions and develop strategies to optimize the movement of goods while reducing emissions. Figure 1 illustrates the methodology adopted to assess the impact of 100% renewable electricity on CO2e emissions in urban freight transport and determine their status in decreasing emissions. The cities collected these indicators using the ICLEI EcoLogistics self-monitoring tool (ICLEI, 2020), and following Geus methodology from 1988, three alternative scenarios were defined: baseline or do-nothing, best scenario (Utopic), and most probable scenario. The scenario approach helps explain the variations arising from different policy actions and political commitments aimed at decarbonizing city logistics. The cities calculated the CO2e emissions generated by freight activity and projected these emissions for the years 2030 and 2050.
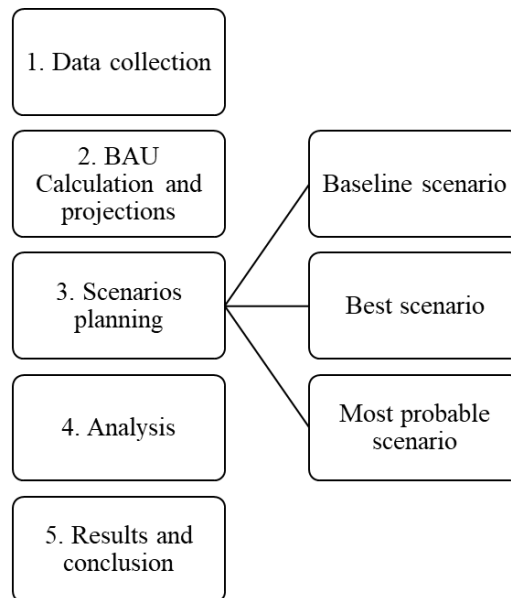
Figure 1. Methodology for calculating CO2e emissions projections and targets.

The study assumes that the freight transport sector will use electricity by 2050. To accurately estimate the emissions generated by freight vehicles, the study employs the EcoLogistics tool (Royo et al., 2020), which uses the GLEC Framework methodology (Smart Freight Centre, 2022) and the greenhouse gas protocol for cities (Fong et al., 2014). This calculation approach necessitates cities to gather activity data (measured in tons-kilometer – tkm) for each vehicle segment and use equation 1 to calculate the corresponding greenhouse gas (GHG) emissions.

$$CO_2e\,(COV_i) = tkm(COV_i) \times kWh/tkm\,(COV_i) \times \text{tons CO2e /per kWh} (\llbracket COV \rrbracket_i, \nabla i \epsilon N, N = number\ of\ COV$$

Equation 1. GHG emissions produced by electricity – (*CO2e - carbon dioxide equivalent, **COV** – Coefficient of Variation, **kWh** – kilowatt hour, **tkm** – tons kilometer)*

The analysis extends its scope to encompass the developments in electricity usage across various vehicle types, further expanding upon the previous equation. Notably, electricity emerges as the dominant technology for vehicles with smaller dimensions and engine capacities, such as light commercial vehicles (LCVs), freight transport vans, and tricycles. However, the optimal technology choice for high goods vehicles (HGVs) remains uncertain, with both hydrogen and electricity being considered. According to an article in The Wall Street Journal, 2021, both technologies offer distinct advantages and disadvantages, including infrastructure requirements.

In 2021, Transport & Environment conducted a comparison between the two technologies, presenting their findings in **Figure 2**. Plötz in 2022 supports the analysis by suggesting that, in most regions and commercial vehicle applications, battery-electric drives outperform fuel cells, particularly in heavy long-distance transport. Additionally, the report highlights that long-distance transport could potentially transition to battery-electric vehicles by 2030, given the availability of charging infrastructure.

These insights contribute to a comprehensive understanding of the evolving landscape of vehicle technologies and inform the study's assessment of emissions and greenhouse gas calculations within the freight transport sector.

Figure 2. Hydrogen vs battery electric trucks - long distance.
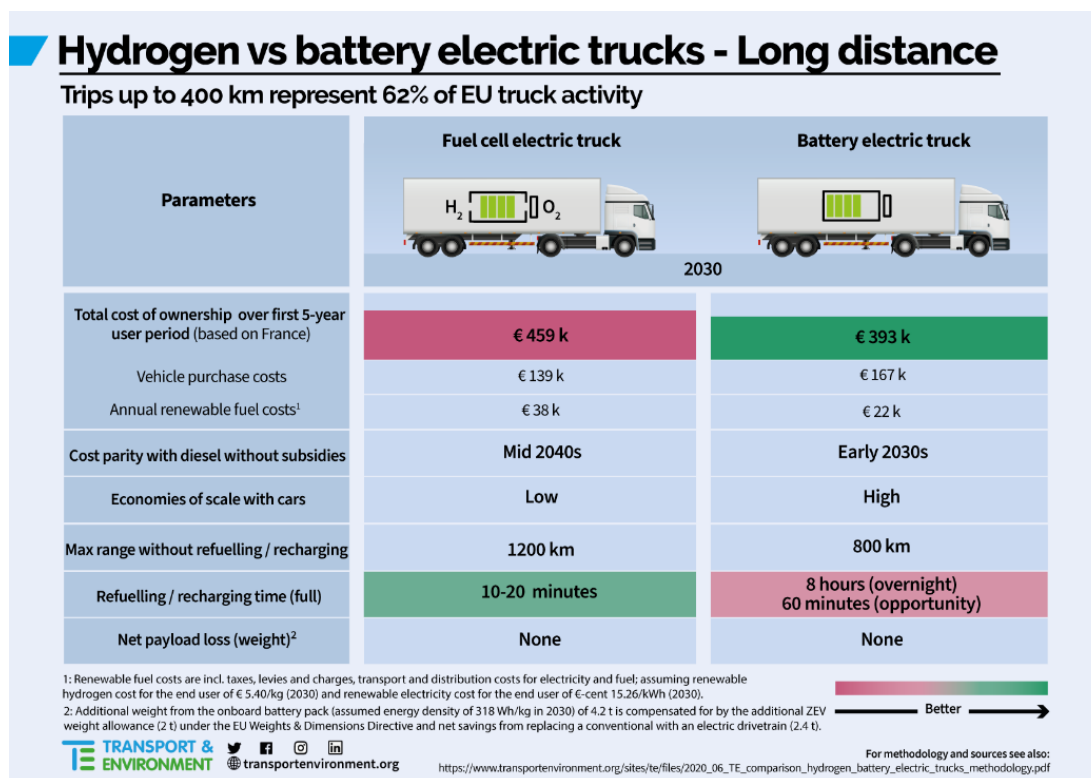
Source:(Transport & Environment, 2021)

Another parameter for equation 1 is the electricity emissions factors. The EcoLogistics tool, calculated carbon dioxide equivalent – CO_2e emissions in electricity-driven scenarios. **Table 1** describes country policies regarding grid and electricity generation.

Table 1. Electricity emission intensity factors ([123])([4])

Energy source for electricity generation	Electricity emission factors (g CO2e per kWh)
Heavily coal-based [1]	850
Fossil-based [1]	500
Average EU	320
Argentina [2]	307
Colombia [3]	182
India [2]	708.2
Renewable ongoing [4]	214.7
Largely decarbonized [1]	30
Others	140

Table 2, on the other hand, consolidates the emission intensity for different vehicle categories following the establishment of baselines. Specifically, for the Light Commercial Vehicle (LCV) category (<3.5t) and the two categories below 12t, the methodology incorporates values sourced from the GLEC Framework (2019). In these cases, the emission intensity values are assumed to be the same as those of the "Rigid Truck (7.5t - 12t)" category. All the figures provided by the sources are expressed in kilowatt-hours per kilometer (kWh/km).

Table 2. Electricity emission intensity factors.

Category of vehicle	kWh/tonne-km	Source of information
Non-Motorized rickshaw/car	0	(UK Government GHG Conversion Factors for Company Reporting 2.0, 2021) [1]
Motorized rickshaw / tuk tuk	0	
Motorcycle (2-wheeler)	0	
Tempo	0	
Light good vehicle (<3.5 t)	1.1	(GLEC Framework, 2019)
Rigid Truck (3.5 t - 7.5 t))	0.5	
Rigid Truck (7.5 t-12t)	0.4	
Rigid Truck (12t-20t)	0.1	(Roeth & Mihelic, 2022) [2]
Rigid Truck (>20t)	0.1	
Truck and Trailer (>20t)	0.1	

[1] Emission factors in kWh/km. The study assumes that values will be zero if the index is in tkm.
[2] According to the authors 2kWh/mile or 1.25kWh/km for HGV (class 8 in US). Assuming a 60% load factor and17% empty running, the result is around 0.1 kWh/tkm.

[1] *The International Energy Agency (IEA) compiles and publishes annually updated lists of national electricity emission factors, and we recommend cities use this as a source of information. Other available sources can be found here: https://www.carbonfootprint.com/docs/2019_06_emissions_factors_sources_for_2019_electricity.pdf
[2] *Country Specific Electricity Grid Greenhouse Gas Emission Factor (Carbon Footprint, 2022).
https://www.carbonfootprint.com/docs/2022_03_emissions_factors_sources_for_2021_electricity_v11.pdf
[3] *. Colombia: Climate transparency
https://www.climate-transparency.org/wp-content/uploads/2021/01/Colombia-CT-2020.pdf
[4] *. Interpolation between the value in 2020 and the largely decarbonized value.

Demonstration Projects

Argentina – Rosario BiciPack Bicycles for sustainable logistics

The public bike system in Rosario has expanded its reach with 20 cargo bicycles available at 8 stations. The cargo bikes have been seamlessly integrated into the system and are fully operational, offering users an additional option to move goods. With two baskets, one measuring 35x34cm at the front and another measuring 46x41cm at the back offering users a convenient and hassle-free solution targeting the shift towards sustainable transportation for small and medium businesses located in the city center, where most last-mile deliveries occur.

Figure 3. Operation area for Bicicargo in Rosario, Argentina.
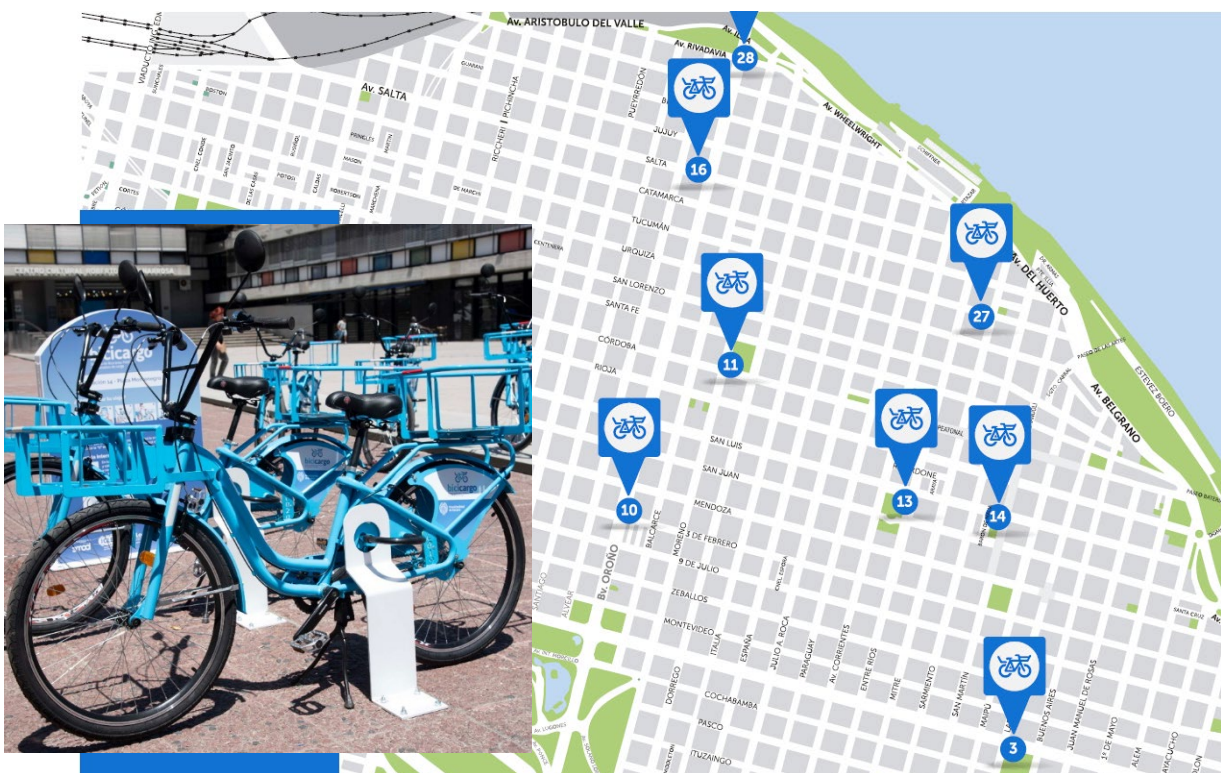
With BiciPack, users can easily reserve a cargo bike through an app to transport goods. After picking up the bike from a station, users have 90 minutes to complete their trip and return the bike to a nearby terminal. The system now allows for advanced reservations and 15-minute stops for intermediate deliveries, making it easier to secure the bike outside of a station. The project included following activities:

- Manufacture of 20 cargo bicycles to fit in the operational characteristics for Rosario.
- Promote the use and local development of more efficient and sustainable modes of urban freight.
- Make visible the impact of urban freight, considering the economic, environmental, and social aspects influential in the sector.
- Provide the commercial and service sector with an alternative for their logistics with sustainable vehicles to reduce travel in conventional motorized modes. Encourage the private sector to acquire zero-emission vehicles.
- Systematize data about the use of the service to assess its scalability. And obtain information to assess industry logistics demand. Developing a public zero-GHG vehicle system for last-mile logistics for shops, neighborhood services, and public transport users.

Colombia – Bogota evaluation of deconsolidation alternatives in zero-emission vehicles for last-mile distribution of packages

The solution provides decision-makers with valuable insights on the most suitable vehicle types for different operational and geographic scenarios. The findings revealed the areas within the city where electric vehicles proved to be efficient for freight and distribution operations.

Figure 4. Bogota EcoLogistics Operations Zones for the deconsolidation of the last mile.
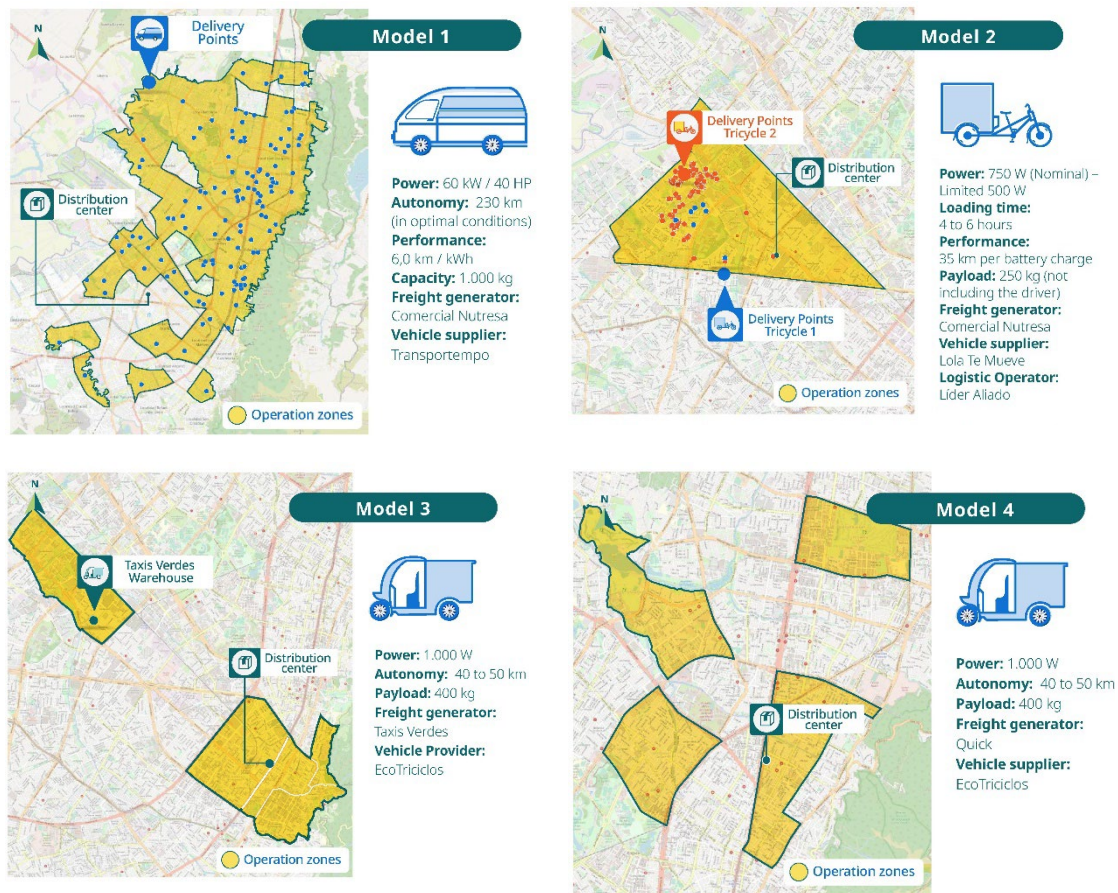
By analyzing four different vehicle models, a comparative evaluation was made possible for various types of vehicles, under distinct geographic and operational conditions. To enhance the partnership between freight companies, the control offices responsible for mobility and the environment in Bogota implemented innovative solutions to enhance air quality and traffic. City officials have requested special attention be given to Barrio Vitales[5] and Zumas[6]. In Figure 4, **Model 1** shows the replacement of a diesel combustion truck with an electric van for delivering packaged food in a city district with air quality problems and high industrial activity. The distribution center is in the main logistic hub for the city. In **Model 2**, one gasoline-powered van is replaced by two electro-assisted tricycles for delivering packaged food within a 3 km radius of operation. **Model 3** replaces one gasoline-powered motor truck with an electric three-wheeler that distributes and collects mainly parcels. **Model 4** replaces two gasoline-powered motorcycles with one electric three-wheeler for distributing medical devices in a specific operational area.

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[5] *Barrios Vitales – Vital Neighborhood give priority to the most sustainable ways of moving, creating infrastructure center in the inhabitants' movilidad Bogota, 2021*

[6] *ZUMA –Urban Zones for a Better Air is a strategy to prioritize the areas with poor air quality Ambiente Bogota, 2021*

India – Shimla freight packing & loading zones

The goal of the project is to decrease traffic violations, enhance sustainable mobility measures such as air quality, pedestrian accessibility, and alleviate congestion caused by limited infrastructure for vehicles in Shimla. The city has identified 17 delivery locations designated as loading and unloading zones. The pilot program entailed providing eco-driving training to employees and stakeholders.

Figure 5. Loading and unloading zone in Shimla city center.

During the demonstration, collaborators measured the following metrics:

- The average parking turnaround time for freight vehicles.
- Total parking turnover for freight vehicles along identified stretches.
- Time is taken to find the loading zones.
- Idling time reduction for loading/unloading of goods at designated space.
- Average time reduction in loading/unloading of goods.
- Reduction in traffic rules infringement by freight vehicles on identified stretches.
- Reduction in congestion due to freight vehicles on identified spaces.

Figure 6. Eco-Driving training for logistics operators

Source: (ICLEI South Asia, 2022)

India – Kochi Introduction of electric loaders in market centers

The project took a step towards replacing 3-wheeler freight vehicles for last-mile deliveries in the Ernakulam Market. To achieve this, they are operating 20 electric LCVs, which will replace current fossil fuel vehicles. This project aims to showcase the feasibility and viability of e-vehicles for transporting goods and shop owners. The Government of Kerala is supporting the adoption of electric vehicles, targeting the operation of 1,000 electric 3-wheeler vehicles in the following years. The Kochi Municipal Corporation shortlisted 20 beneficiaries, while ICLEI South Asia has co-funded up to 40 percent of the showroom price of the e-cargo vehicles. The identified beneficiaries come from diverse sectors, such as distributors of vegetables, gas, drinking water, food, and courier packages, among others, to achieve a wider impact.

Figure 7. Demonstration project inauguration in Kochi.

As per NITI Aayog, around 8 million light goods vehicles are expected to be operational in the urban delivery segment by 2030 (56 % of the total freight vehicles). Therefore, the joint initiative by ICLEI South Asia, Kochi Municipal Corporation, and the private sector, with support from the Kochi Metropolitan Transport Authority, highlights the determination of the city to make a big difference in decarbonizing urban logistics, improving efficiency, and increasing gender equity by providing customized training to women beneficiaries for increased participation in urban logistics. The demonstration reduces incognita in the technologies as many cities are hesitant to adopt these vehicles due to concerns about its workability, suitability, performance, and operating costs in the private sector. EcoLogistics increase the evidence of real-time operations, financial viability, and performance for these vehicles in Kerala. To address these concerns, the demonstration shows the benefits of low-emission freight vehicles for last-mile goods delivery.

- During its monitoring period, the project saved 1400 kiloliters of diesel, resulting in an emission reduction of 24.95 tons of CO_2e.
- The potential impact could include the reduction of GHG emissions to 25000 tons of CO_2 annually.

Data for the following indicators were collected, the information is utilized to measure and compare different trends respectively to the baselines and previous hypothesis.

- Daily Battery consumption vs Diesel Consumption – Energy Consumption
- Driving Range left at the end of the day
- Distance covered at delivery areas (to get dead kilometers)
- Percentage of distance in the delivery area
- Delivery area energy consumption
- Number of stops
- Number of delivery addresses
- Energy consumption per 100 Kilometers
- Energy Consumption per Kg Km
- Energy consumption per delivery

India – Panaji Promotion of collaborative last-mile delivery

The demonstration project encompasses two key components: the introduction of a fleet comprising 29 electric freight vehicles, including 14 three-wheelers (3-W) and 15 two-wheelers (2-W), with the aim of replacing the conventional internal combustion engine (ICE)-based fleet of light commercial vehicles (LCV) and two-wheelers for last-mile deliveries in Panaji. Additionally, the project validates the concept of load pooling by utilizing electric freight vehicles.

Figure 8. Operation of e-last-mile in Panaji.

The demonstration is a benefit to both the local and state government due to its ability to:

- Validate and promote the concept of load pooling for good delivery.
- It reduces the overall number of trips required to deliver the same goods.
- Showcase the potential of electrification of the urban freight fleet to reduce emissions and improve air quality.
- Develop an ecosystem to scale up the adoption of electric freight vehicles by deploying charging infrastructure, increasing awareness, and proving the viability of electric goods vehicles to private stakeholders.
- Strengthen partnerships between the public and private sectors to develop EcoLogistics initiatives.

The following indicators were collected to measure and compare different trends respectively to the baselines.

- Daily battery consumption vs diesel consumption – energy consumption
- Driving range left at the end of the day
- Distance covered at delivery areas (to get dead kilometers)
- Percentage of distance in the delivery area
- Delivery area energy consumption
- Number of stops
- Number of delivery addresses
- Energy consumption per Kg Km
- Energy consumption per delivery
- The total load carried – average load per trip
- Increase in the load factor of vehicles.
- Reduction of freight vehicle movements in Kms.
- Reduction in the number of km per vehicle per delivery.
- Increase in the rate of available loading possibilities.

Cities have limited application of this e-transport policy due to various concerns related to these vehicles' workability, suitability, performance, and operating costs in the private sector. The evidence of real-time operations, financial viability, and performance in India, particularly Kochi and Panaji, was limited, EcoLogistics provide information about benefits of low-emission freight vehicles in the last mile movement.

Calculating emissions projections

As part of their research, EcoLogistics created a baseline to identify indicators in all participating cities. During this process, the team discovered that certain indicators had never been measured before (ICLEI, 2021). In the next phase, the working group collaborated with stakeholders from various business and leadership levels to investigate and document the emissions generated by freight operations based on the data collected in the previous report. These sources provide valuable insights that enable the evaluation of various scenarios.

Baseline scenario – do nothing

The baseline scenario assumes that no action has been taken to replace the fleet by 2030 and 2050. The CO2e projections are based on the business-as-usual (BAU) scenario considering the road freight transport activity will increase by 3.3% annually through 2030 and 2050 (ITF, 2021). The energy mix is assumed as largely decarbonized and the same over the three-time frames (2019, 2030, 2050).

Best scenario – Utopic

This scenario provides insights into the short-term, present, and long-term future of using exclusively clean electric vehicles. It considers the electricity sources for these vehicles, focusing on three-time horizons: 2019, 2030, and 2050. Although this scenario is unrealistic, assuming all vehicles are electric and energy is mostly decarbonized, it serves as a baseline for other scenarios. The BAU (business as usual) scenario considers electric vehicles and a decarbonized energy mix, combining elements from previous scenarios. The energy mix gradually evolves from 2020 to 2050, with the 2030 value interpolated between today's energy mix and the scientific target (GLEC, 2020).

In this scenario, fuel types for each vehicle category are aggregated, using predominantly decarbonized electricity. The energy mix in all three horizons is expected to be decarbonized, resulting in zero CO2 emissions during the electricity life-cycle consumption phase. However, projected GHG emissions for CO2e account for both the consumption and production phases of the electricity life cycle, resulting in emissions above zero. The best scenario achieves nearly zero emissions due to a decarbonized energy mix. However, as freight activity grows, GHG emissions are expected to increase. Projections assume the 3.3% of annual increase in road freight transport activity under the BAU scenario, with 100% clean electricity by 2030 and 2050 (ITF, 2021).

This scenario combines fuel types for all vehicles and relies on predominantly decarbonized electricity. CO2 emissions during the electricity life-cycle consumption phase are zero, but GHG emissions above zero are projected for CO2e, considering both consumption and production phases of the electricity life cycle.

Most probable scenario – realistic

Based on the thorough analysis of all available data, scenario planning, community feedback from local experts, and demonstration project outcomes, the low carbon action plans for urban freight (LCAP-UF) potential targets have been carefully evaluated to develop the most likely scenario. To achieve the LCAP-UF goals, Zaragoza Logistic Center - ZLC recommends a five-step process that involves conducting demonstrations in selected cities and utilizing all available data. This approach is highly effective and provides a clear path towards achieving the desired outcomes.

- **STEP 1 - ZLC for demo projects**: Analyze the data available and feedback EcoLogistics indicators to be taken in the cities.
- **STEP 2 - Demo cities collect data:** agreeing with the towns and operators using the EcoLogistics indicators for urban freight (ICLEI Local Governments for Sustainability, 2022).
- **STEP 3 – ZLC analysis and preliminary results:** ZLC includes different assumptions in fleet replacement and policy building for future years.
- **STEP 4 - Cities validate the results and refinements:** Cities have access to scenarios and assumptions to remark on and confirm the vision of city experts.
- **STEP 5: Targets calculation and conclusions:** ZLC provides the final report with the overall analysis for the demonstration projects.

This scenario envisions the future based on the "business as usual" scenario from 2019, but with a greater degree of certainty. It considers various vehicle configurations and the carbon intensity of the electricity grid over time. The scenario assumes a significant reduction in carbon emissions by 2050, with a transition phase beginning in 2030. The research shows that by implementing specific policies, electrifying fleets, and transforming the electricity grid, local governments can achieve emission reduction targets. The model anticipates that by 2030, all vehicles weighing under 3.5 tons will be electric, and 60% of diesel/gasoline vehicles in the same weight category will be replaced. The remaining fleet will remain unchanged from the 2019 scenario. By 2050, the entire fleet will consist of electric vehicles, and 80% of vehicles weighing over 3.5 tons will be electric.
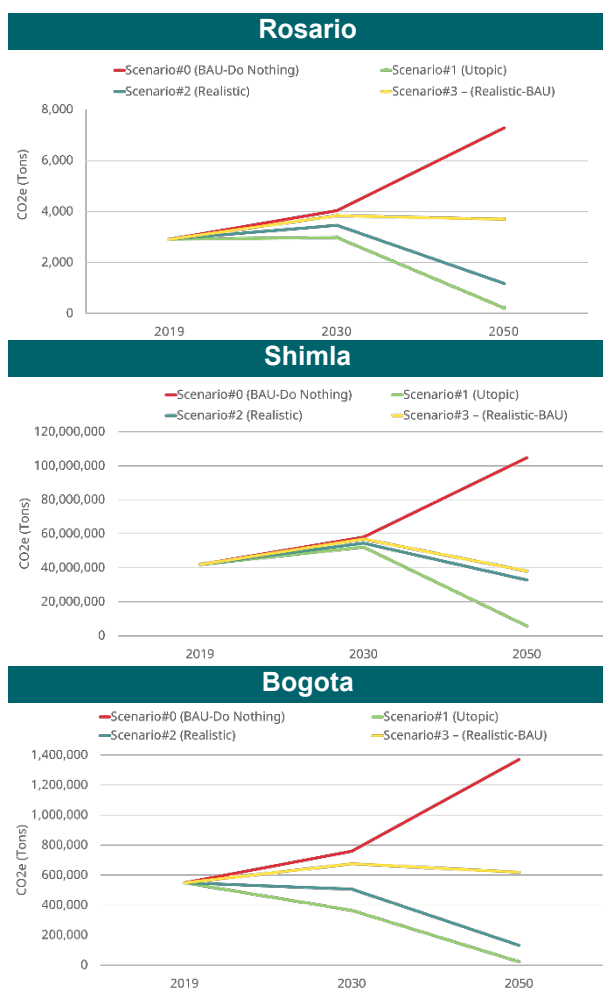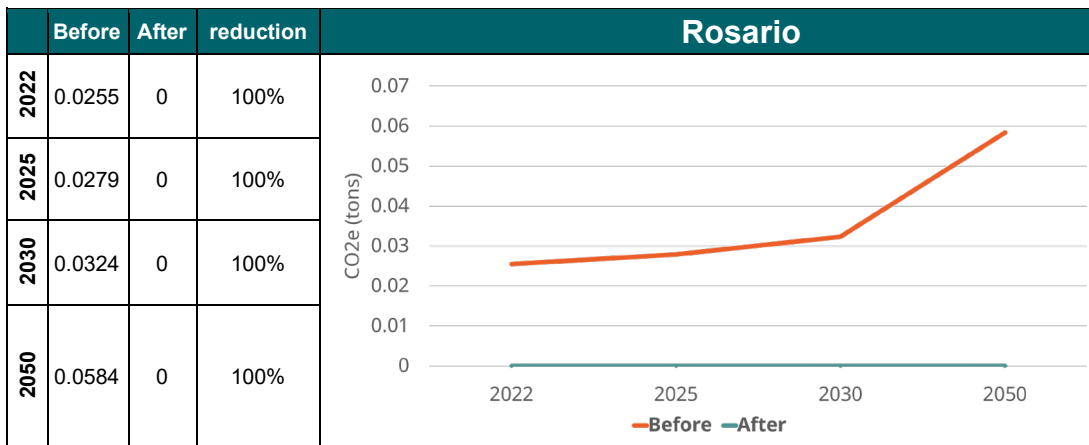

The graphics on the left revealed the studied scenarios. Here It is showed the importance of tailor policies for each local government to effectively transition to cleaner fleets, and that a single system cannot address all issues. In general, we do not see a one-size-fits-all approach to the issue; instead, it underscores the importance of continued efforts to reduce carbon emissions and highlights the need for changing consumer behaviors to achieve a significant reduction in emissions.

Rosario revealed a unique policy approach to confidently transition to electric fleets, and the model predicts that the gradual growth of renewable energy sources will impact potential reduction targets. The most positive and complex scenario predicts a 26.18% reduction in emissions by 2030 and a 97.03% reduction by 2050. **Bogota** is expected to have even greater emission reductions, with a 56.60% reduction by 2030 and a 98.40% reduction by 2050 given the energy sources to produce electricity. While **Shimla** presents a more challenging scenario, The analysis predicts a 10.09% reduction by 2030, However, if the electricity grid undergoes a significant transformation, it could contribute to a reduction of 94.48% by 2050.

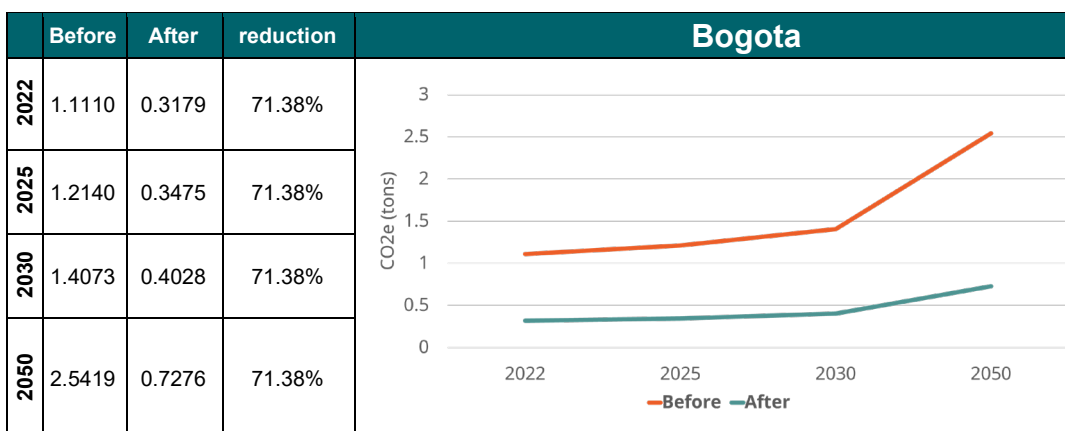# Comparative analysis: before and after scenarios

By increasing the use of cargo bikes in Rosario, there is a likelihood of reducing emissions in the designated operational zone depicted in **Figure 3**. The estimated CO2 emissions in Rosario are projected to be nearly eliminated after implementing this new business model, demonstrating the significant impact cargo bikes can have. The diagram below illustrates the observable effect within the studied area.

Table 3. Comparison Rosario after pilot project implementation. Reduction is dependent on the national energy mix.

	Before	After	reduction	Rosario
2022	0.0255	0	100%	
2025	0.0279	0	100%	
2030	0.0324	0	100%	
2050	0.0584	0	100%	

In Bogota, the use of low to zero-emission technology in vehicles is expected to lead to a reduction in CO2 emissions, although the extent of this reduction is subject to variation and depends on the charging infrastructure provided by the energy network and matrix in the country. The emission index of vehicles is affected by their type, with freight vehicles contributing to higher levels of emissions. The impact of this trend is illustrated in the diagram below, which highlights the effects within the area under study in **Figure 4**.

Table 4. Comparison Bogota after pilot project implementation. Reduction is dependent on the national energy mix.

	Before	After	reduction	Bogota
2022	1.1110	0.3179	71.38%	
2025	1.2140	0.3475	71.38%	
2030	1.4073	0.4028	71.38%	
2050	2.5419	0.7276	71.38%	

The effects of the newly implemented loading and unloading areas in Shimla were closely monitored for a month prior and two months after the project implementation. The findings, presented in **Table 5**, provide

insights into the impact on freight and traffic, which have significant implications for urban logistics in the seventeen transformed hubs of Shimla.

Table 5. Comparison of Indicators before and after implementation.
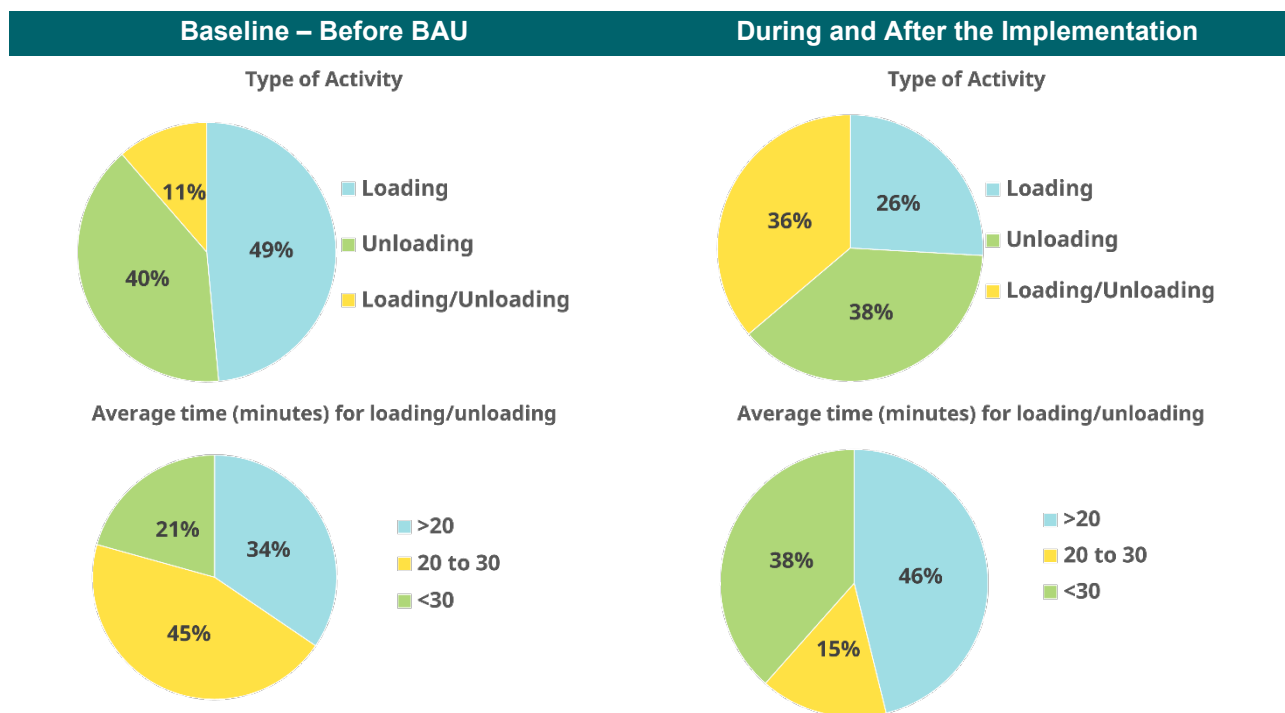
There have been efforts to replace vehicles with low to zero-emission technology in Panaji and Kochi. However, the current energy matrix in India and the fuels used to produce electricity are expected to increase emissions, making it challenging to adopt e-vehicles as a sustainable option in the short term. As the number of kilometers, vehicles, and tons moved increases, CO_2e emissions are likely to follow suit. **Table 6** illustrates the differences in CO_2e tons proposed to emit by year and the impact of the national energy mix on reducing emissions. It is worth noting that Kochi is almost one-third larger than Panaji in terms of area and size.

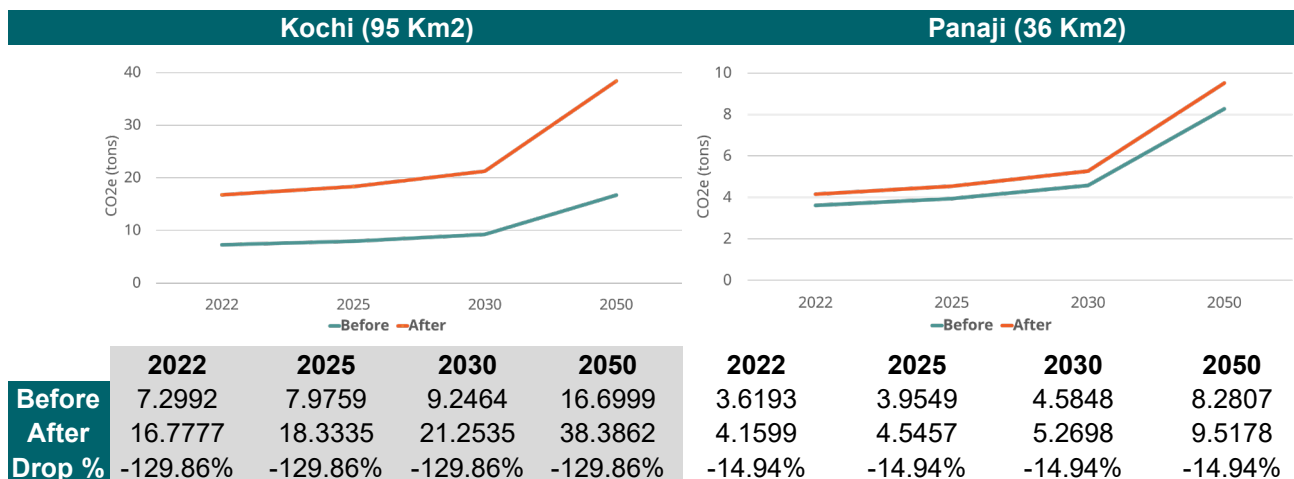**Table 6.** Comparison of Kochi and Panaji emissions after project implementation. Reduction is dependent on the national energy mix.

	2022	**2025**	**2030**	**2050**	**2022**	**2025**	**2030**	**2050**
Before	7.2992	7.9759	9.2464	16.6999	3.6193	3.9549	4.5848	8.2807
After	16.7777	18.3335	21.2535	38.3862	4.1599	4.5457	5.2698	9.5178
Drop %	-129.86%	-129.86%	-129.86%	-129.86%	-14.94%	-14.94%	-14.94%	-14.94%

Recommendations to move forward

This study provides a rough estimate of fleet technology replacement in the demonstration cities, based on simplified assumptions and shortened timelines. After examining urban freight scenarios in three different countries, the EcoLogistics trials confirm that decarbonizing urban freight transport requires a combination of measures and policy-building plans through local Low Carbon Action Plans (LCAP-UF) and National EcoLogistics Policy Recommendations (NELPR). It is crucial for cities to adopt zero-emission vehicles, as the automotive industry and countries are evolving to enable the transition to electric vehicles. In the short term, the focus for heavy goods vehicles (HGVs) is on transition fuels to renew fleets and achieve decarbonization targets.

In **Rosario**, it was observed that if vehicles with a gross weight under 3.5 tons were electric, the potential reduction in CO2e emissions would be impacted by the carbon intensity of the electricity grid in Argentina. A stable energy mix could lead to a reduction of approximately 27.46% in emissions. Drastic reductions occur when the carbon intensity of the electricity grid decreases. To facilitate change, an increase in the share of renewable fuel sources is necessary to decarbonize the electric grid, which is crucial for successful electrification of the fleet.

In the case of **Bogota**, if all vehicles with a gross weight under 12 tons were electric, GHG emissions would be significantly reduced. The carbon intensity of the electricity grid is already low and is expected to be almost fully decarbonized, reaching around 98% by 2050. This provides an opportunity for the city to implement policies that promote the replacement of conventional vehicles with electric ones, resulting in a dramatic decrease in GHG emissions.

For **Shimla**, **Kochi**, and **Panaji**, it appeared that if vehicles with a gross weight under 3.5 tons were electric, the carbon intensity in India could increase GHG emissions. India needs to prioritize the decarbonization of its electricity grid to achieve a reduction in emissions. Policymakers should provide mechanisms to electrify the fleet while ensuring the use of clean energy by transport service providers to avoid any negative impact.

EcoLogistics analysis suggests that targeting a 100% uptake of zero-emission urban freight vehicles in EcoLogistics cities is crucial for accelerating the reduction of GHG emissions. The scenarios demonstrate that by transitioning the fleet to electric vehicles, emissions can decrease from 100% to 60% by 2030, and by 2050, the shift to electric vehicles will lead to a drastic reduction in emissions. However, further work is required to adopt cleaner grids at the national and regional levels.

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