



EXPANDING ACCESS TO FINANCING FOR ZERO-EMISSION TRUCKS IN LATIN AMERICA AND THE CARIBBEAN

November 2023



AUTHORS

CALSTART

Ricardo García Coyne

Grupo Emobilitas

Gustavo Jiménez Vera

Miriam Monterrubio

Josemaría Jiménez

Aldo Cerezo

Tomás Garduño

ACKNOWLEDGMENTS

This report was funded by the ClimateWorks Foundation. The authors would like to thank Jeremy Croes and Ruthlyn Lindor (Aruba), Erick Collado and Alexandra Cedeno (Dominican Republic), Miguel Deweever and Jessica Rogers (Sint Marteen), Tilly Pikerie and Dwigno Puriel (Curaçao), Marcelo Padilla and Armando Pérez (Chile), Lionel Franceschi (AFD), Luis Abalo (KfW), Amado Crotte (IDB), Andrés Alcalá (CAF), Sergio Martínez (EIB), Jone Orbea (UNEP), Francisco Cabeza (formerly at Element Fleet Management), Jorge Cernadas (Enel X), Margaret Boelter (Zeem Solutions), Rebecca Saletta (Zeti, Inc), Sita Holtslag, Stephanie Kodish, Owen MacDonnell, Brian Rand and Michael Joseph (CALSTART), and CALSTART's Investor Council for their valuable input. Conclusions, recommendations, and errors are the authors' own.

No part of this document may be reproduced or transmitted in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without prior written permission by CALSTART. Requests for permission or further information should be addressed to CALSTART, 48 S. Chester Ave, Pasadena, CA 91106 or Publications@CALSTART.org.

© Copyright 2023 CALSTART

Global Commercial Vehicle Drive to Zero

www.globaldrivetozero.org

@TeamDriveToZero

CALSTART

www.calstart.org

@calstart

TABLE OF CONTENTS

AUTHORS AND ACKNOWLEDGMENTS	iii
ACRONYMS	2
EXECUTIVE SUMMARY	3
INTRODUCTION	6
1. THE FREIGHT SECTOR IN LATIN AMERICA AND THE CARIBBEAN	7
1.1 FLEET COMPOSITION	7
1.2 AVERAGE FLEET AGE	8
1.3 PROFILE OF TRANSPORT OPERATORS	9
1.4 FREIGHT EMISSIONS	10
1.5 ELECTRICITY PROVISION IN LAC	11
2. ZERO-EMISSION FREIGHT IN THE LATIN AMERICAN AND CARIBBEAN MARKETS	13
2.1 THE ENVIRONMENTAL OPPORTUNITY	13
2.2 THE ECONOMIC OPPORTUNITY	13
2.3 TECHNOLOGY READINESS	14
2.4 ELECTRIC MOBILITY TARGETS	16
2.5 EXAMPLES OF ZET DEPLOYMENTS IN LATIN AMERICA	17
2.6 SUMMARY OF CURRENT STATUS IN LAC AND DECARBONIZATION POTENTIAL	18
3. ROLE OF FINANCE TO ACCELERATE ZET ADOPTION	20
3.1 CURRENT TRANSPORT OPERATOR PROCUREMENT MODELS	20
3.2 FINANCIAL INSTRUMENT ARCHETYPES	21
3.3 PRIVATE SECTOR FINANCE	23
3.4 INTERNATIONAL DFIs' ROLES AND FUNDING ALLOCATION PROCESSES	25
3.5 INTERNATIONAL DFI PROGRAMS AND POTENTIAL	27
3.6 ZET FINANCING SOLUTIONS	31
4. CONCLUSIONS AND RECOMMENDATIONS	35
APPENDIX	38
REFERENCES	41

ACRONYMS

AFD	Agence Française de Développement
CAF	Development Bank of Latin America and the Caribbean
CAPEX	Capital Expenditure
CDB	Caribbean Development Bank
CO ₂	Carbon Dioxide
DFI	Development Finance Institution
ENME	National Electric Mobility Strategy
ESG	Environmental, Social, and Governance (commitments)
GCF	Green Climate Fund
GEF	Global Environmental Facility
GFDT	Global Facility to Decarbonize Transport
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
Global MOU	Global Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles
IADB	Inter-American Development Bank
ICE	Internal Combustion Engine
IFC	International Finance Corporation
KfW	German Development Bank
km	Kilometers
kW	Kilowatts
kWh	Kilowatt-Hours
LAC	Latin American and the Caribbean
NADBank	North American Development Bank
NAFIN	Nacional Financiera
NOx	Nitrogen Oxides
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
PHEV	Plug-in Hybrid Electric Vehicle
PM	Particulate Matter
TCO	Total Cost of Ownership
UNDP	United Nations Development Program
ZE-MHDV	Zero-Emission Medium- and Heavy-Duty Vehicle
ZET	Zero-Emission Truck
ZEV	Zero-Emission Vehicles

EXECUTIVE SUMMARY

Freight transportation plays an important role in the economic development of Latin American and Caribbean (LAC) countries, but it is also a major source of emissions. The road freight sector contributes between 3–4 percent to countries' gross domestic product. At the same time, it is a critical sector to decarbonize given that freight trucks contribute disproportionately to air pollution and climate change. While they represent less than 4 percent of the on-road fleet, they are responsible for close to 27 percent of on-road greenhouse gas emissions, more than 60 percent of nitrogen oxides emissions, and over half of particulate matter emissions, which have severe impacts on human health.

Zero-emission trucks (ZETs) are needed to maintain and grow the road freight economy while mitigating impacts on the climate and communities. Governments and companies largely agree that the future of transport is zero-emission, and LAC needs to ensure its industry, fleets, and communities are not left behind. Regulation establishing goals and timelines will be key to ensure a gradual transition. The global market is expected to see around 9 million new jobs and an average annual spending of \$3.5 trillion USD up to 2050 in zero-emission vehicles and charging infrastructure; LAC needs to be a part of this growth. Furthermore, with ZETs, freight is no longer reliant on externalizing costs on communities. ZET lifetime emissions are 61–92 percent lower than their diesel counterparts, and by having zero tailpipe emissions, they eliminate the impact of air pollution on human health (valued at over \$5 billion USD annually in the United States alone).

The LAC region has ambitious decarbonization champions making strides in the zero-emission truck and bus space. As of September 2023, six countries in the region (Chile, Uruguay, Aruba, Curaçao, Sint Maarten, and the Dominican Republic) have signed the Global Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles, committing to work together to achieve 100 percent new zero-emission truck and bus sales by 2040, with an interim target of 30 percent by 2030. Similarly, Colombia aims to have all new bus sales be zero-emission by 2035, and Barbados aims to be 100 percent fossil fuel-free by 2030. In terms of adoption, as of late 2023, Chile had over 2,000 electric buses in operation and Colombia over 1,500. In 2022, Mexico saw close to 1,700 purchase orders of zero-emission trucks and vans, and major fleets like Grupo Bimbo and Anheuser-Busch are demonstrating that a zero-emission freight future is not only possible but highly desired.

Despite early progress, the high upfront cost of vehicles and charging infrastructure is among the biggest barriers limiting adoption at scale. With the right financing, some vehicle segments can already offer savings when compared to their diesel counterparts. However, uncertainties related to infrastructure availability, residual values, technology readiness, and transition timeline increase the perceived risk of investments, which limits widespread access to low-cost financing. Additionally, the lack of professionalization and pervasive business informality among micro and small fleets (which control over 50 percent of the market in the countries analyzed) severely limit the number of fleets that can access financial products.

International development finance institutions (DFIs) are playing a key role in unlocking access to capital for zero-emission buses and should play a similar role for ZETs. The success that zero-emission buses have had in the region is in no small part a result of financial innovation and close collaboration between governments and international DFIs, such as the German Development Bank, the World Bank, and the Inter-American Development Bank. Out of all the zero-emission transport programs carried out in the countries analyzed, only one was fully earmarked for ZETs, and it represented 0.08 percent of the total investment in zero-emission transport. Furthermore, the investment allocated to zero-emission transport in the countries analyzed was about \$2 billion USD, while investment in LAC highways by the Inter-American Development Bank alone amounted to \$16.5 billion USD. Much more capital needs to be mobilized to support ZET deployments.

This analysis shows that **international DFIs** can accelerate ZET adoption by unlocking affordable finance through four key actions:

- 1. Increase concessional funding for ZETs and charging infrastructure, leveraging lessons learned from electric bus projects.** LAC is a global leader in zero-emission bus deployment, in no small part because of projects that have successfully deployed concessional funding to structure bankable projects and de-risk private investment in bus electrification. The truck segment needs a similar kind of support. Similarly, DFIs must avoid the use of concessional funding for fossil fuel-based deployments in segments where zero-emission technologies are viable. Investing in fossil fuels diverts resources needed for an accelerated transition and sends mixed signals to the market.
- 2. Accelerate large fleet electrification through bundled solutions, residual value guarantees, and facilitation of procurement at scale.** Residual value guarantees could support captive finance providers and leasing companies to partially mitigate the risk of uncertain values at the end of the leasing term and thus lower the cost of leasing. Demand aggregation can lower the cost of vehicle procurement through economies of scale, unlock the potential of shared charging infrastructure, and send a strong market signal to original equipment manufacturers. Bundled solutions (inclusive of capital and operational expenditures for vehicles and infrastructure) can be supported through long-term loans that can be passed on to customers, allowing them to enter long-term agreements that maximize operational savings and thus reduce total cost of ownership.
- 3. Ensure new investments in highways and grid infrastructure expansion can be future-proofed to meet transport charging demands.** The fleet of the future will be largely battery-electric and as such will require a robust, carbon-free electricity grid and reliable access to charging infrastructure. DFIs invest heavily in highway and grid expansion, which presents an opportunity to ensure that these investments reflect future electric vehicle charging needs. Through a standardized assessment of new highway investments, DFIs could promote charging station buildout at appropriate intervals, ensuring all new highways are supportive of zero-emission vehicles. Through similar assessments, based on long-term grid infrastructure plans co-developed by utilities and governments, DFIs can ensure that new grid expansion projects are sized correctly and able to satisfy transport electricity demand in the long term, both from publicly available charging stations and depots.
- 4. Support financial inclusion of small owner-operators with tailored financing solutions.** Non-refundable incentives paired with subsidized loans will likely be needed to offer an ownership-based procurement solution that is attractive for small fleet operators, since they are used to buying used diesel trucks. Bundled finance solutions paired with demand aggregation can offer the same cash flow benefits to small fleets as they do to large fleets, and as-a-service business models like those used by Zeem Solutions and Fluid Truck in the United States can be supported by DFI long-term financing to electrify this segment.

To the same end, **national governments** can facilitate access to affordable finance through three key interventions:

- 1. Reduce market uncertainties through regulations, standardized data collection, and planning to shape the market in the mid to long term.** Regulatory requirements establishing industry expectations are foundational to inform market behavior. Supply-side mandates (such as California's Advanced Clean Trucks regulation) are a highly effective tool to ensure adoption and provide mid to long term market certainty. Moreover, governments should prioritize the collection of comprehensive and high-quality trucking data and long-term infrastructure planning. Lack of reliable data increases investment risks and thus the cost of finance. Identifying factors creating market uncertainty must be an ongoing process that engages private-sector investors and allows national governments to address their concerns.
- 2. Ensure inclusion of ZETs in country strategy negotiations with development banks and global facilities.** National governments receiving DFI support have a large degree of influence in determining the areas of focus of that support. Ensuring freight is included will allow countries to set aside concessional funding to stimulate private investment and accelerate ZET adoption. At the same time, ZET needs should be mainstreamed across other relevant portfolios, including renewable

energy generation, grid expansion, highway expansion, and economic sectors relying on trucks for everyday operations.

- 3. Professionalize the freight sector. Governments need to collaborate with small owner-operators and the companies that hire their services to promote business formalization.** Professionalization efforts should prioritize improving operational practices and financial training, as well as developing new procurement contracts that are supportive of ZETs by including longer service periods and bonuses for carbon-footprint reduction and brand positioning. Governments can incentivize professionalization by providing technical assistance to small business owners coupled with preferential credit loans and incentives to transition to ZETs.

INTRODUCTION

Freight transportation in Latin America and the Caribbean (LAC) plays an important role in the economic development of countries, contributing between 3–4 percent to countries' gross domestic product [1]. At the same time, it is a critical sector to decarbonize given that road transport accounts for 17 percent of total emissions worldwide [2]. Freight trucks contribute disproportionately to these emissions: while they represent less than 4 percent of the on-road fleet, they are responsible for close to 27 percent of on-road greenhouse gas (GHG) emissions and emit more than 60 percent of nitrogen oxides (NOx) and over half of particulate matter (PM2.5) emissions, which have severe impacts on human health [3].

Zero-emission trucks (ZETs) are a proven solution to mitigate these impacts. For this study, zero-emission vehicles include battery-electric and hydrogen fuel cell vehicles, which have zero tailpipe emissions. Model availability is growing across all vehicle segments, and fleets are gaining hands-on experience with regulation acting as a critical backbone of the transition. However, the number of transport operators adopting ZETs in LAC is still small. One of the key challenges limiting adoption at scale is the higher upfront cost of ZETs, which can be up to three times higher than that of internal combustion engine (ICE) vehicles [4]. Even though the operational costs of ZETs are lower and total cost of ownership (TCO) parity is expected within this decade across many vehicle segments, limited access to finance risks leaving many fleets behind and slowing the pace of the transition.

This white paper assesses the primary risks and uncertainties that impede widespread access to financial products and services for transport operators seeking to adopt ZETs and proposes strategies to overcome these challenges through targeted action and collaboration with development finance institutions (DFIs). The paper focuses on LAC countries with strong commitments to transition to ZETs, namely Chile, Uruguay, Colombia, Mexico, the Dominican Republic, Curaçao, Aruba, Sint Maarten, and Barbados. Six of these countries are among the global frontrunners who have signed the Global Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles (Global MOU) [5], a co-led initiative by the Government of the Netherlands and CALSTART/Drive to Zero, through which 27 nations have committed to work together with the aim of achieving 100 percent new zero-emission medium- and heavy-duty vehicle sales by 2040, with an interim target of 30 percent by 2030.

CHAPTER 1

1. THE FREIGHT SECTOR IN LATIN AMERICA AND THE CARIBBEAN

1.1 FLEET COMPOSITION

Country territory and population play a large role in determining freight modes and intensity. Countries with large territories such as Mexico, Chile, and Colombia have the greatest need for medium- and heavy-duty vehicles that allow operators to move goods across large distances. Urban areas and smaller countries tend to rely on lighter duty vehicles best positioned to move goods rapidly over shorter distances. Table 1 illustrates territory surface and population of the countries analyzed.

Table 1. Country Territory and Population

Country/Region	Latin America				Caribbean				
	Colombia	Chile	Uruguay	Mexico	Dominican Republic	Barbados	Curaçao	Aruba	Sint Maarten
Territory surface (km ² thousands)	1,141.75	756.10	176.22	1,964.38	48.44	0.43	0.44	0.18	0.03
Population (thousands)	52,215	19,960	3,416	129,875	10,790	279	162	119	35

Source: E-Mobilitas elaboration with different census of information by country.

While there is no precise data on modal split across LAC countries, it is estimated that, on average, more than 70 percent of freight in the region is moved by trucks [6]. Table 2 describes the modal share of goods movement for countries where information is available. The volume of goods moved on roads ranges between 73–93 percent, with Uruguay having the highest reliance on roads and Colombia and Mexico the lowest due to larger rail activities.

Table 2. Freight Modal Split in Selected Countries

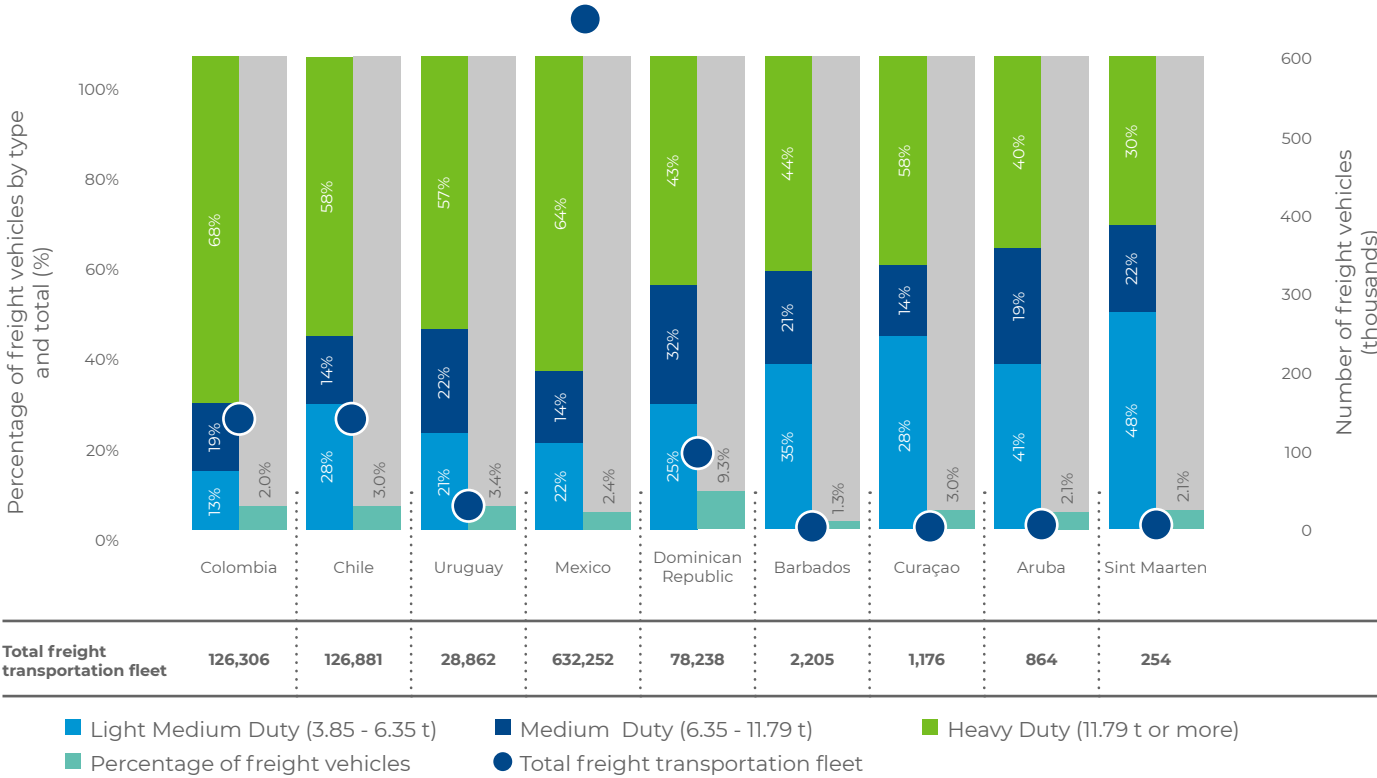
Country/Region	Mode			
	Highway	Rail	Maritime	Others
Chile [1]	93.0%	4.0%	3.0%	N/I
Colombia [7]	73.2%	25.5%	0.99%	1.04%
México [1]	73.0%	13.0%	4.0%	10.0%
Uruguay [8]	97.0%	3.0%	N/I	N/I

Note: "N/I" stands for no information available. All data is rounded.

Sources: The Inter-American Development Bank (IDB) [1], Mining-Energy Planning Unit – UPME [7], and CAF Technical Cooperation | DNE – MIEM [8].

Despite the high volume of freight moved by trucks, these vehicles represent a small percentage (in most cases under 5 percent) of the total vehicles on the road. Two-axle trucks and three-axle tractor-trailers account for most of the vehicles in the sector, as shown in Figure 1. The disproportionate impact that such a small share of vehicles has on the environment and people’s health emphasizes the need for fast, targeted decarbonization efforts.

Figure 1. Percentage of Freight Vehicles with Respect to the Total Fleet by Country

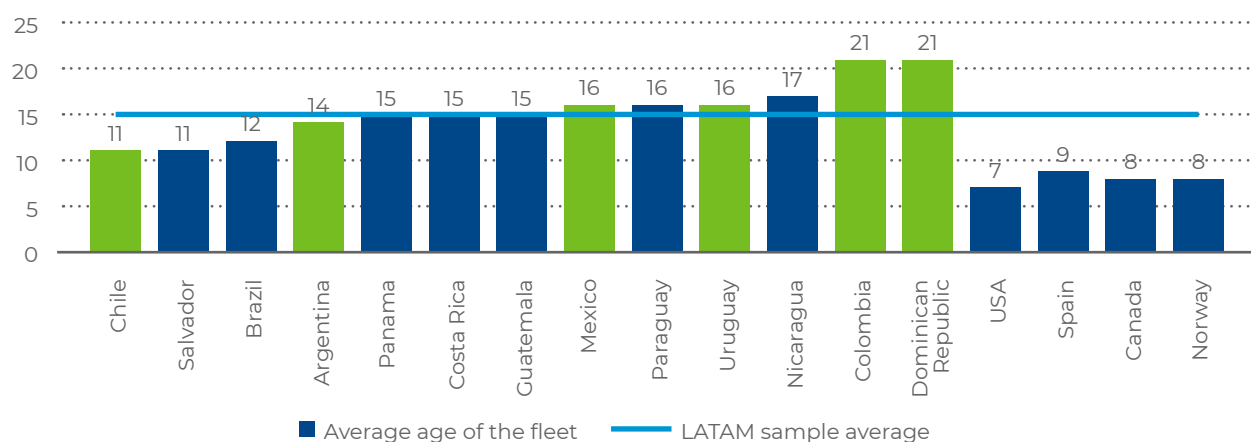


Sources: Mining-Energy Planning Unit – UPME [7], National Registry of Cargo Dispatch Information (RNDC) [9], National Institute of Statistics Chile [10], CAF Technical Cooperation | DNE – MIEM [8], National Vehicle Fleet Information [11], and Vehicle Park 2021 [12].

1.2 AVERAGE FLEET AGE

Trucks in LAC tend to be much older than their counterparts in developed markets due to higher purchase rates from the secondary market, lack of stringent emissions standards, and slower replacement schedules driven by limited access to finance. In Colombia and the Dominican Republic, the truck fleet age is on average over 20 years old. In contrast, in developed economies such as the United States, Canada, and Norway, the average truck fleet age is under 10 years. The prevalence of older trucks has severe negative climate and health impacts given that a truck sold in 2002 emits 20 times more PM2.5 and four times more NOx than a truck sold today [13].

Figure 2. Average Age of the Freight Transportation Fleet



Source: Automotive freight transportation in Latin America [14].

Furthermore, the importation of used ICE trucks compounds this problem and puts countries at risk of ending up with old polluting models that no longer meet the standards to operate in other markets. Colombia, Chile, and Uruguay are among the countries with a strict ban on used vehicle imports [15], [16], [17]. Barbados controls the used vehicle market by limiting the mileage and age of import-eligible trucks and applying substantial taxes [18]. Mexico, in contrast, has weak controls over the segment and has seen considerable increases in imports as a side effect of the COVID-19 pandemic due to fleets' need to minimize spending [19].

1.3 PROFILE OF TRANSPORT OPERATORS

The landscape of freight companies in LAC is highly fragmented. While company-size categorizations vary by country, across the markets analyzed around 97 percent of freight service providers are micro and small companies, controlling over half of the truck fleet with averages of between 2–13 trucks per company. Large companies, which represent less than 1 percent of the companies in the space, control 28 percent of the fleet, with averages ranging between 77–293 trucks per company (see Table 3). Company size is a key factor that heavily influences fleet renewal schedules and electrification potential. While large companies operate in the formal market and tend to have access to capital and robust vehicle monitoring systems in place, small owner-operators do not. This inequality creates a structure in which the oldest, most polluting vehicles are at the same time those harder to replace.

Table 3. Number of Companies by Size

Country	Size	Number of companies	Number of vehicles	Average veh/company
Colombia [20]	Micro	15,374	64,060	4.17
	Small	3,064	37,568	12.26
	Medium	399	13,428	33.65
	Large	123	11,250	91.46
Chile [21]	Micro	15,192	53,972	3.5
	Small	890	11,819	13.3
	Medium	366	11,313	30.9
	Large	380	29,311	77.1
Uruguay [22]	Micro	1,703	12,121	7.1
	Small	507	7,733	15.3
	Medium	208	7,402	35.6
	Large	20	1,606	80.3

Country	Size	Number of companies	Number of vehicles	Average veh/company
Mexico [23]	Micro	160,773	295,253	1.8
	Small	32,040	369,844	11.5
	Medium	4,173	211,103	50.6
	Large	1,280	376,820	293.0

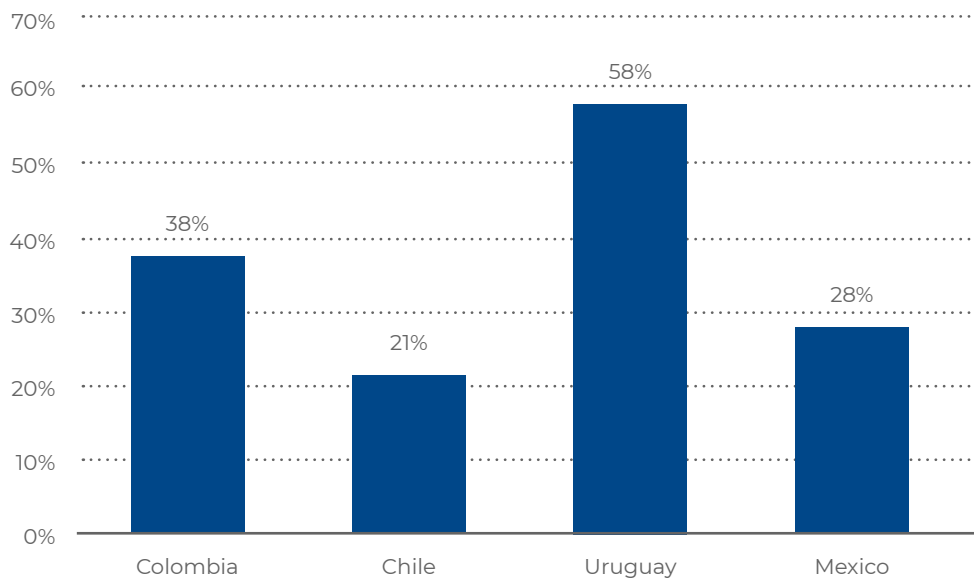
Sources: How many companies are there in Colombia [20], APL Road Freight Transportation Sector Diagnosis [21], The road freight transportation market in Uruguay [22], and Basic Statistics 2022 [23]. Note: For Columbia, numbers were estimated by authors based on total fleet in Colombia and the number of companies in the sector.

1.4 FREIGHT EMISSIONS

As stated previously, the transportation sector plays a major role in the emission of GHGs and harmful pollutants, with freight trucks accounting for close to 27 percent of GHG, 60 percent of NOx, and over half of PM2.5 emissions from road transportation globally [3].

LAC has a higher share of emissions (31 percent) [24] from the transportation sector than the global average (17 percent) [2]. Furthermore, LAC's transport emissions relative to economic output are the highest in the world except for Africa, at 0.98 tonnes of carbon dioxide (CO2) for every \$10,000 USD.

Figure 3. Percentage of GHG Emissions from Road Transportation



Sources: National and Departmental Inventory of Greenhouse Gases – Colombia [25], Vehicle Categories [26], Uruguay National Inventory of Greenhouse Gases 1990-2019 [27], and National Inventory of Emissions of Greenhouse Gases and Compounds (INECyCEI) [28].

NOx and PM2.5 emissions deserve particular attention given the serious impacts they have on human health, including lung and heart ailments, asthma, cognitive impairment, and premature death. In 2015, over 180,000 premature deaths were attributed to emissions from diesel vehicles [29]. Table 4 below illustrates the air pollution impacts of medium- and heavy-duty vehicles in comparison to lighter duty vehicles.

Table 4. Pollutant Emissions by Type of Vehicle in One Year of Operation (tons)

Truck / Emission of Gases	CO _{2e}	CN	PM ₁₀	PM _{2.5}	SO ₂	CO	NO _x	COT	COV	NH ₃	Toxic	CH ₄	NMV OC	NO ₂
Light Medium Duty 3.85 - 6.35 t (base vehicle)														
Quantity value	30.24	0.02	0.04	0.03	0.00	0.17	0.15	0.71	0.14	0.00	0.03	0.001	0.04	0.002
Value in percentage	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Medium Duty 6.35 - 11.79 t														
Quantity value	57.24	0.03	0.08	0.05	0.00	0.57	0.62	0.32	0.26	0.00	0.05	0.000	0.12	0.003
Value in percentage	189%	197%	177%	185%	176%	331%	407%	185%	182%	185%	181%	60%	288%	125%
Heavy Duty 11.79 t or more														
Quantity value	83.16	0.04	0.12	0.07	0.00	0.97	1.08	0.49	0.42	0.01	0.09	0.006	0.21	0.003
Value in percentage	275%	271%	280%	240%	275%	563%	714%	280%	295%	270%	300%	1200%	475%	150%

Source: Data from an analysis of Greenhouse Gas emissions in the Transport Subcategory of the National Institute of Ecology and Climate Change and the United Nations Development Program (UNDP), Mexico [100].

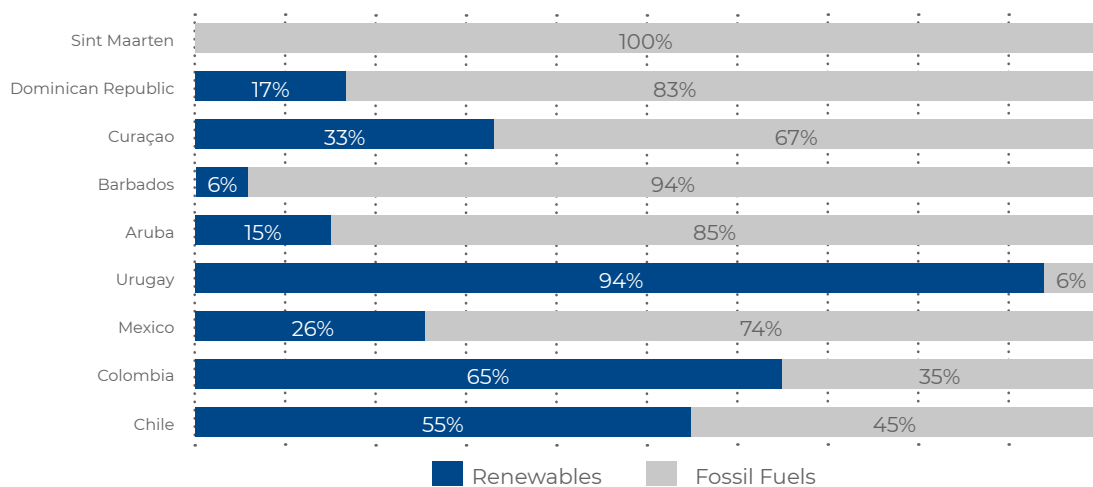
Note: This table considers an average of 108,000 kilometers traveled per year.

Emissions values are intricately tied to the unique conditions prevailing in each country. Factors like vehicle age, driving habits, weight, size, load capacity, maintenance practices, fuel sources, and even weather conditions can significantly impact emissions levels. As a result, emissions may differ across LAC countries. Nonetheless, the general trend of larger vehicles contributing disproportionately to air pollution remains consistent throughout the region.

1.5 ELECTRICITY PROVISION IN LAC

Central and South America are leaders in renewable electricity generation, which represents over 70 percent of their electricity supply (of which hydropower accounts for close to 80 percent) [30]. This low-emission energy matrix is not only promising to power electric vehicles but also to grow energy-intensive manufacturing activities which can further reduce vehicles' life-cycle emissions. However, within this region, there are extreme cases in the use of renewable energy. For instance, Paraguay and Uruguay have over 94 percent of electricity generation free of emissions. On the other end of the spectrum, Sint Maarten relies on fossil fuels for 100 percent of its electricity generation, followed by Barbados at 94 percent, as depicted in the following figure. This situation may influence the willingness of original equipment manufacturers (OEMs) to increase ZET availability in a country, as affordable renewable electricity maximizes emission reductions and cost competitiveness.

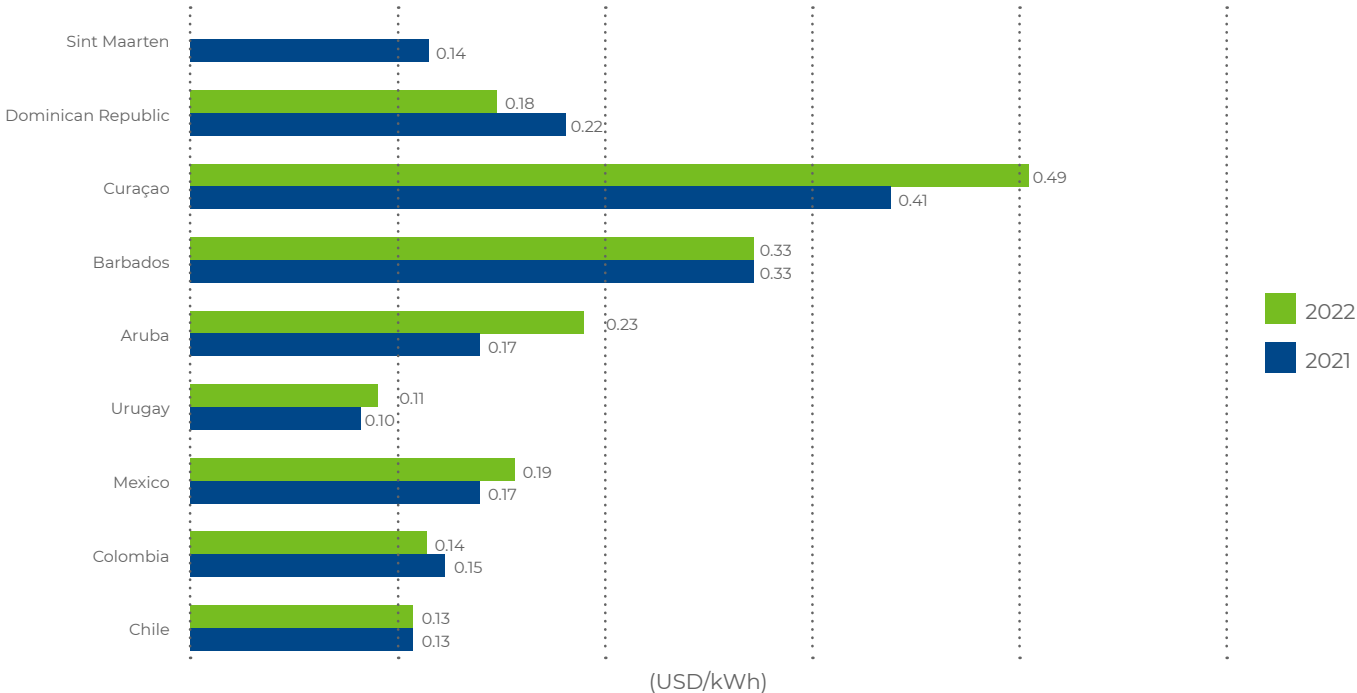
Figure 4. Electric Energy Profile



Sources: Energy profiles for different countries: Aruba, Barbados and Colombia: International Renewable Energy Agency [31], Curaçao: National Renewal Energy Laboratory "Energy Snapshot" [32], Energy Generation and Management Bulletin [33], Sint Maarten, Energy Snapshot [34], Background update report 2022 [35], National Energy Balance 2020 [36], and Renewable Energies in Uruguay [37].

The cost of electricity is a major factor in the economic case for ZETs and is largely dependent on the energy sources used to create it and how these are obtained. In addition to the cost per kilowatt-hours (kWh), utilities tend to apply additional costs such as demand and service charges, which depend on the total capacity in kilowatts (kW) that is available at a specific location. These costs vary at the site level, and are thus hard to approximate, but remain a critical piece in the pricing puzzle that needs to be accounted for and that can be adjusted to improve the business case for zero-emission transport.

Figure 5. Average Price of Electricity in Selected Countries in Latin America in 2021 and 2022



Sources: Caribbean countries 2021: Worldwide Electricity Pricing: Energy Cost Per Km in 230 countries [38], Aruba 2022: Aruba energy prices [39], Barbados 2022: Barbados energy prices [40], Curaçao 2022: Government of Curaçao [41], Dominican Republic 2022: Dominican Republic energy prices [42].

Apart from Colombia and Chile, where there are more than three electric utility companies operating throughout their territories, the rest of the countries analyzed have a single entity responsible for the generation, transmission, and distribution of electricity. This offers an important opportunity to scale up utility-led solutions and coordinate electricity distribution at the national level. In countries such as Colombia [43], Chile [44], Uruguay [45], Mexico [46], and Aruba [47], utilities have begun implementing initiatives to promote electric vehicle adoption, including electrification guidelines, special tariffs, and charging station deployment. Electricity generation and distribution company Enel has expanded its activities through Enel X to include comprehensive offerings to support electric vehicle adoption, including vehicle finance, charging station provision and installation, operation, maintenance, and energy sales to end users. Other utilities around the world are adopting these new roles and will play a determinant role in accelerating the transition.

Long-term grid infrastructure planning to satisfy vehicle charging needs will be critical to ensure the transition to zero-emission vehicles (ZEVs) is successful. It is incumbent upon national governments to promptly establish regulatory requirements to inform near- and long-term planning, as well as necessary grid upgrades, given that new transmission lines or substations can take over four years to complete. A good practice to address this issue is exemplified by New York State: in June 2023, the New York Assembly passed bill A5052 requiring state government agencies and utilities to collaboratively identify electric grid improvements needed to satisfy long-term electric vehicle charging needs [48]. Regulation of this kind is necessary in LAC to guarantee charging availability and effectively manage costs of grid infrastructure upgrades.

CHAPTER 2

2. ZERO-EMISSION FREIGHT IN THE LATIN AMERICAN AND CARIBBEAN MARKETS

2.1 THE ENVIRONMENTAL OPPORTUNITY

Replacing traditional ICE trucks with ZETs will play a critical role in freight decarbonization. While diesel-powered trucks are the largest source of on-road air pollution (NOx and PM), ZETs have zero tailpipe emissions. As such, they eliminate the severe health impacts that these emissions have on people's lives. Taking the United States as an example, a 2021 study found that with an 80-percent renewable electricity grid (which some countries in LAC already have), the economic value of avoided climate and health damages resulting from electrified trucking could exceed \$5 billion USD annually. From a public health standpoint, the case for ZETs is clear [49].

ZETs are still responsible for emissions generated during the vehicle manufacturing, raw material extraction, and electricity generation processes; however, when considering the life-cycle emissions of ZETs and diesel trucks, ZETs considerably outperform other technologies. Battery-electric trucks (model 2021, Europe) produce 61 percent lower lifetime emissions than their diesel counterparts. Furthermore, if the grid was powered fully by renewables, emissions would be 92 percent lower than diesel. With commercially available hydrogen being produced from natural gas, fuel cell electric trucks offer 15–33 percent emissions reductions today compared to diesel. With hydrogen produced exclusively from renewables (which will be key to decarbonize hard to abate sectors such as aviation, maritime, and green steel manufacturing), emissions would be up to 89 percent lower than diesel [50]. From a climate standpoint, the case for ZETs is also well established.

2.2 THE ECONOMIC OPPORTUNITY

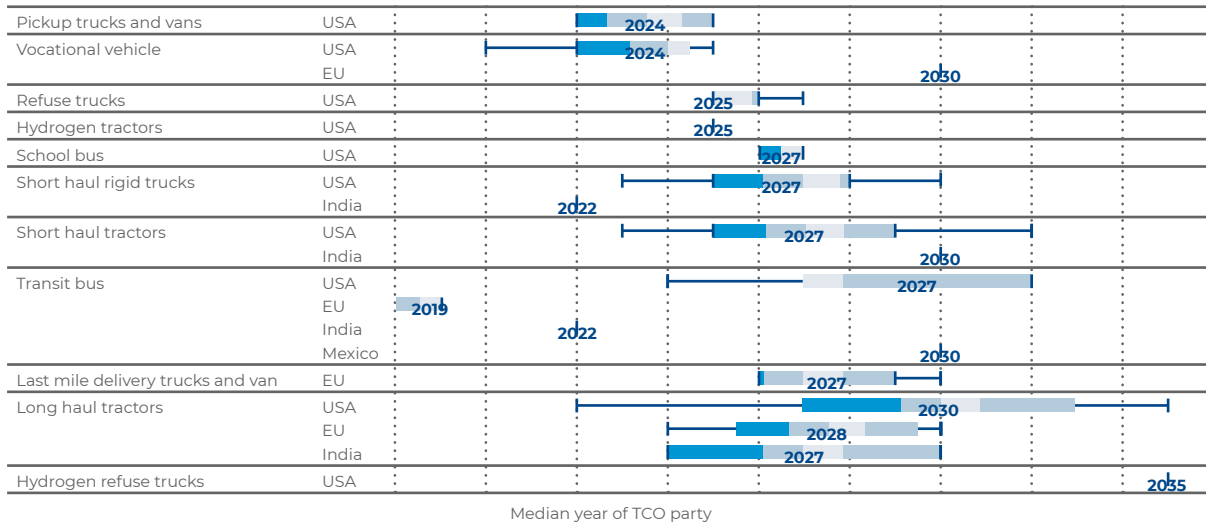
The economic opportunity of ZETs cannot be overstated. For manufacturing companies and governments, an accelerated transition to ZEVs will allow them to capture part of the \$3.5 trillion USD a year estimated to be spent on vehicles and charging/refueling infrastructure between 2021 and 2050 [51]. As ICE manufacturing slowly begins to phase out, direct operations and maintenance jobs in ZEV manufacturing are expected to create around 9 million jobs [52]. Attracting a substantial portion of these jobs will be critical for the region and in particular countries that currently play a large role in the ICE supply chain, such as Mexico.

The costs associated with acquiring an ICE vehicle differ from those of electric vehicles. Electric vehicles have a higher capital expenditure (CAPEX) due to the costs associated with more expensive vehicles and the need for charging infrastructure. For instance, in Mexico, the JAC X350 model's electric version costs 133 percent more than its diesel version [53]. The 1.5-ton cargo van, in its electric version, is 88 percent more expensive than its combustion counterpart [54]. Beyond this, the infrastructure required to charge the vehicles adds an additional expense. A 30-kW charger alone ranges between \$15,000 and \$25,000 USD in Mexico, depending on the type of connector used. As a result, CAPEX for electromobility projects tends to be notably higher compared to conventional ICE vehicles.

However, ZETs make up for their higher CAPEX with reduced operational expenditures (OPEX) derived from lower maintenance and refueling costs. When the right financing products are available, fleets base purchasing decisions on vehicles' TCO, which considers all the CAPEX and OPEX costs over a vehicle's useful life.

TCO parity between ZETs and ICE trucks has already been achieved in some markets, particularly for delivery vans and public transit buses. As shown in Figure 6, analyses to date show that TCO parity is expected across most segments and markets before 2030. After TCO parity is achieved, ZETs become the most cost-effective option for fleets, generating economic benefits for carriers, shippers, and clients.

Figure 6. Median Year of TCO Parity Between Heavy-Duty ZE and ICE Vehicles in Literature by Market and Vehicle Segment



Source: International Council on Clean Transportation (ICCT) [55]. Licensed under a Creative Commons Attribution-ShareAlike 4.0 International License. Design alterations made by e-Mobilitas.

2.3 TECHNOLOGY READINESS

The lack of vehicle models available to meet truck fleet needs is often cited as a barrier to adoption. While this may still be the case in some early-stage markets, the number of models commercially available has increased drastically in the international market over the past five years. As of 2023, over 400 zero-emission truck and van models are commercially available worldwide (Figure 7).

Figure 7. Zero-Emission Truck and Van Models Available Worldwide



Source: CALSTART Drive to Zero's Zero-Emission Technology Inventory Data Explorer [56].

In the LAC region, model availability varies across countries and is closely related to vehicle demand. The largest number of OEMs with ZET offerings was identified in Mexico, Colombia, and Chile. Availability is more limited at present in the Caribbean, with the notable exception of Barbados. The following Table 5 illustrates the ZET offerings that are commercially available in the countries analyzed, as well as the potential for short-term availability given the presence of the OEM dealers in each country. Models that may be available via importers on demand are not reflected in the table, although these offerings can play a pivotal role in jumpstarting the market.

Table 5. ZET Offerings in the Countries Analyzed

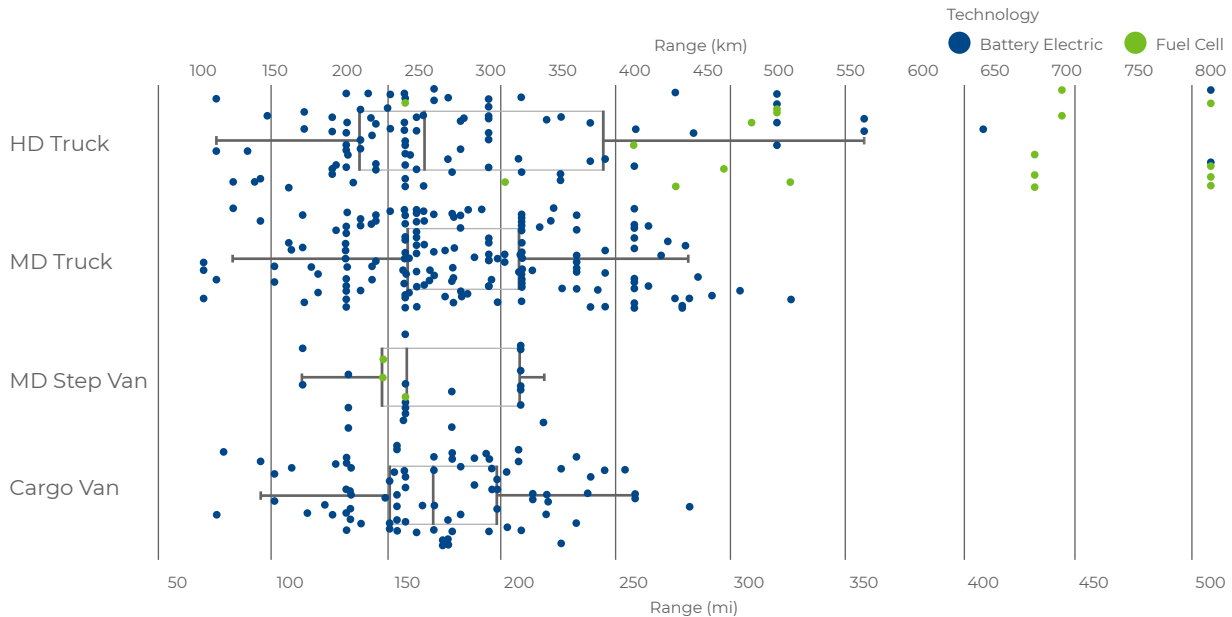
Company	Model	Aruba	Barbados	Curaçao	Dominican Republic	Sint Maarten	Chile	Colombia	Mexico	Uruguay
BYD	T3		✓				✓	✓	✓	✓
BYD	T45		✓				✓	✓	✓	✓
BYD	T5		✓				✓	✓	✓	✓
BYD	T6		✓				✓	✓	✓	✓
BYD	T7		✓				✓	✓	✓	✓
BYD	T8		✓				✓	✓	✓	✓
BYD	T9		✓				✓	✓	✓	✓
BYD	T10		✓				✓	✓	✓	✓
BYD	Q1		✓				✓	✓	✓	✓
Dayun	E3								✓	
Dayun	E7								✓	
FAW	6003 Electric								✓	
FAW	J6F 5T								✓	
Foton	TM3 EV								✓	
Foton	View EV								✓	
Foton	Aumark S3 EV								✓	
Ford	e-transit						✓		✓	
Freightliner	e-cascadia									
Freightliner	eM2									
Hyundai	Hyzon									
International	EMV								✓	
Isuzu	NRR EV								✓	
Iveco	eDaily								✓	
JAC	E10XCargo	✓					✓	✓	✓	✓
JAC	E Sunray City	✓					✓	✓	✓	✓
JAC	E Sunray	✓					✓	✓	✓	✓
JAC	E X350	✓					✓	✓	✓	✓
Kenworth	T680E								✓	
Kenworth	K270E/K370E									
Kenworth	T680 FCEV									
KingLong	KT610									
Maxus	eDeliver 3			✓			✓	✓	✓	✓
Maxus	eDeliver 9			✓			✓	✓	✓	✓
MegaFlux									✓	
Mercedes-Benz	eActros									
Renault	Kangoo E-tech			✓				✓		
Scania	25P							✓	✓	
Volvo	FH Electric									
Volvo	FM Electric									
Volvo	FMX Electric									
Volvo	FE Electric									
Volvo	FL Electric									
VW	e-Delivery									
VW	e-Crafter									

✓ Model Available in the Country
 Dealer Available

Source: E-Mobilitas elaboration based on publicly available information on OEM and distributor websites.

Another key concern often cited is range anxiety: the inability of ZEVs to satisfy fleets' range needs. However, market data demonstrates that ZETs can already satisfy most fleet needs, offering ranges between 110 and 800 kilometers (km). The ZET landscape is dominated by battery-electric vehicles, although hydrogen fuel cell truck availability is growing for some specific use cases in the long-haul segment.

Figure 8. Zero-Emission Truck Range



Source: CALSTART Drive to Zero's Zero-Emission Technology Inventory Data Explorer [56].

2.4 ELECTRIC MOBILITY TARGETS

The adoption of electric mobility has gained significant attention in the LAC region as countries aim to reduce GHG emissions, improve air quality, and achieve sustainable transportation systems. Chile, Uruguay, Aruba, Curaçao, Sint Maarten, and the Dominican Republic have signed the Global MOU, committing to work together to achieve 100 percent new zero-emission medium- and heavy-duty vehicle sales by 2040, with an interim target of 30 percent by 2030 [5]. Additional targets have been set at the national level to gradually ramp up ZEV adoption [57]:

- **Colombia:** By 2025, 10 percent of urban bus sales are expected to be zero-emission, increasing to 100 percent by 2035. By 2030, Colombia aims to have a fleet of 600,000 electric vehicles across all vehicle segments [58].
- **Chile:** By 2035, Chile aims to have 100 percent of new sales of light-duty vehicles, urban buses, and taxis be electric. Additionally, by 2045, the country aims for 100 percent of new sales of vehicles for freight transportation and intercity buses to be electric.
- **Mexico:** The targets proposed in Mexico by the Ministry of Environment and Natural Resources (SEMARNAT) through the National Electric Mobility Strategy (ENME), not yet approved, include 50 percent of total vehicle sales being electric or plug-in hybrid electric vehicles (PHEV) by 2030; 100 percent of light-duty and heavy-duty passenger vehicle sales being electric or PHEV by 2040; and 100 percent of light-duty and heavy-duty passenger vehicle sales being electric by 2050. The yet-to-be-approved ENME does not establish targets for heavy-duty freight vehicles [59].
- **Uruguay:** Uruguay's target is for light cargo vehicles to be 100 percent zero-emission by 2040 and all cargo vehicles be zero-emission by 2045.

Government targets are a critical step to align ambition across the private and public sector while giving long-term guidance to the industry. Governments need to translate targets into enforceable regulations that compel ZEV uptake. While progress has been made in some fronts, the regulatory landscape in most countries still lacks standards or mandates that scale ZEV offerings and bring technology costs down, fiscal incentives that strengthen the business case until TCO parity is achieved, and regulatory obligations that require the availability of clean and cost-competitive electricity to satisfy fleet demands.

2.5 EXAMPLES OF ZET DEPLOYMENTS IN LATIN AMERICA

Despite the challenges that exist in early markets, several companies in LAC have already begun to deploy ZETs. Three illustrative examples are spotlighted below:

A) GRUPO BIMBO

Grupo Bimbo, the world's largest baking company, headquartered in Mexico, has made significant strides in integrating electric delivery vehicles into its fleet in Mexico. In 2022, Bimbo announced the acquisition of 1,001 electric delivery vehicles for product distribution in Mexico. The vehicles, called Vekstar Stellar, are developed and assembled in Mexico and have been in production since 2013. With this acquisition, Grupo Bimbo became the company with the largest number of electric vehicles in Latin America, reaching a total ZEV fleet size of over 2,300. The Vekstar Stellar electric vehicles offer a range of 130 km and a 1.3-ton load capacity. Each unit prevents the emission of 5 tons of CO₂e into the atmosphere annually [60].

B) GRUPO MODELO

Grupo Modelo (Anheuser-Busch InBev) is Mexico's leading beer manufacturing, distribution, and sales company. In collaboration with Global MOU endorser Megaflux and Element Fleet Management, Grupo Modelo has taken significant steps toward zero-emission transportation in Mexico. The company deployed the first fleet of heavy-duty electric trucks in Mexico back in 2021, and in 2023 inaugurated the first charging station for heavy electric vehicles in Mexico City, with an investment of \$400,000 USD.

The charging center enables Grupo Modelo's fleet of trucks, which currently has 132 units, to be charged within two hours. The initial capacity is for 16 delivery trucks, but the station has the potential to accommodate up to 32 21-ton trucks. The vehicles have a range of 160 km, and through the innovative leasing model offered by Element, electric trucks have been offered at a similar price point with traditional diesel vehicles.

Grupo Modelo aims to expand the charging infrastructure to other locations, such as the state of Monterrey, and plans to have 200 electric units by the end of 2023, 500 by 2025, and carbon neutrality by 2040 [62].

C) ELECTROLOGISTICS EXPERIENCE

The Electrologistics Program in Chile is a public-private initiative that promotes the use of electric vehicles for urban logistics while generating and providing data to facilitate decision-making for companies interested in adopting electromobility. Led by the Conecta Logística Foundation, with support from Corfo, the Energy Sustainability Agency, and the Logistics Development Program of the Ministry of Transport and Telecommunications, this program demonstrates the opportunities generated through public-private cooperation.

The initiative, known as the "Electrologistics Experience," allows urban logistics cargo carriers to explore electric mobility technologies, access information, conduct tests, and experience the benefits of electric mobility. The program involves companies supplying electric urban distribution vehicles, energy companies, municipalities, telemetry companies, and electric charging infrastructure companies.

Several companies contribute to the initiative by providing vehicles and charging infrastructure. Andes Motor supplies vehicles from Maxus and Foton, Dercomaq provides JAC vehicles, SCK offers JMC vehicles, and Indumotora provides Hyundai Trucks. Charging infrastructure is supported by A3E, Vivipra, Copec Voltex, Enel X, and ENEX e-Pro. Telemetry companies such as ETrans, Geotab, and Movia provide sensors for monitoring operational data.

Additionally, the municipalities of Santiago and Providencia have designated priority parking areas for electric urban distribution vehicles to analyze the logistical effects of preferential access to central commercial areas [64].

2.6 SUMMARY OF CURRENT STATUS IN LAC AND DECARBONIZATION POTENTIAL

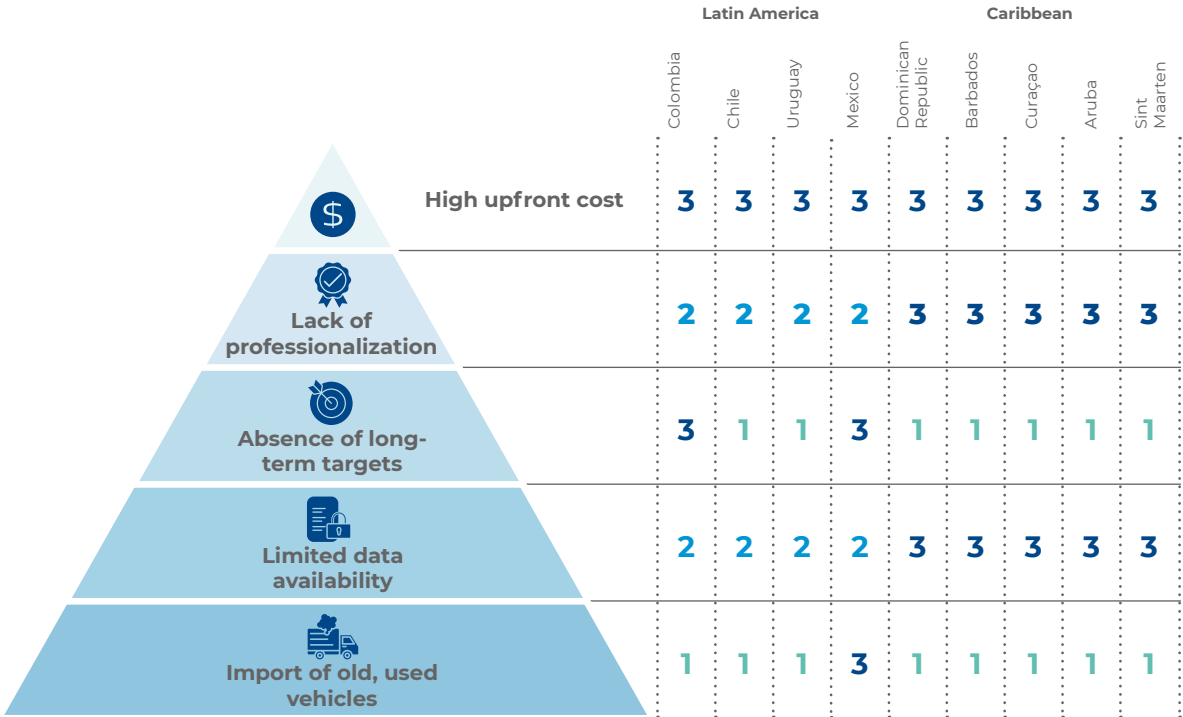
Freight decarbonization is urgent. ZETs offer the potential to reduce GHG emissions; improve air quality and health; reduce operational costs for fleets; and create sustainable, long-term jobs. ZETs are commercially available, their cost is decreasing, and successful deployments in the LAC region are already showing the benefits and possible pathways to scale up adoption.

Small island states in the Caribbean have strong potential to accelerate truck electrification. Trucks tend to travel shorter distances, so range is not a barrier. Lighter trucks, with lower price points and more model options on the market, represent a larger share of the total fleet. Fuel is expensive given the need to ship it in, while the potential for renewable energy generation can offer low-cost, low-emission power to satisfy vehicle charging needs. Finally, governments from the countries analyzed have adopted ambitious decarbonization targets, laying the groundwork for the development of regulatory frameworks that give certainty to the market and catalyze its potential. Improvements are needed in freight data generation and analysis that can inform the development of regulation and help materialize the economic opportunity that ZETs offer.

The larger countries analyzed have larger transportation systems, longer routes, a larger number of small fleets, and needs for a larger diversity of vehicle classes. However, they also have a higher number of zero-emission models commercially available, growing track records of successful deployments, more sophisticated logistics operations and financing solutions, and more developed policy and regulatory frameworks. In terms of ambitious decarbonization targets and renewable electricity generation, the region has global leaders (Chile, Uruguay) as well as other countries (such as Mexico) that need improvement in some areas but have the potential to become central players in the global transition to ZETs.

Challenges such as the high upfront costs of truck acquisition, the lack of professionalization, and the high reliance on an old vehicle fleet are prevalent across all countries analyzed. Binding regulation that establishes a clear timeline for technology replacement will be needed to create market certainty. The following pyramid describes the main challenges faced by the sector, starting with the biggest barrier: the high upfront cost of truck acquisition.

Figure 9. Main Challenges



Note: Scale: 1 – it is not a problem; 3 – it is a problem.

The high upfront cost of ZETs is among the largest barriers limiting adoption at scale. It creates the need for financial products that allow fleets to balance cash flows and make up for the high initial investments with the operational savings that ZETs offer. In both large Latin American economies as well as smaller Caribbean islands, financing is the main way to acquire new units, since very few transport operators have the capital to make direct purchases.

However, the number of fleets that can access financing tends to be limited to formal companies. The lack of professionalization and pervasive informality severely limits the number of fleets that can access financial products, given that companies operating in the informal sector tend to have low or non-existent credit scores and are unable to provide collateral. Formalization and adoption of professionalized management schemes such as those used by large fleets can allow small owner-operators to secure positive qualifications and increase access to capital.

The lack of comprehensive trucking information in LAC countries poses challenges to accurately understand the sector and formulate effective public policies. On top of this, it has negative impacts on investment facilitation, since it hinders international benchmarking (i.e., does not allow stakeholders to accurately compare an investment opportunity in these markets to those in other markets), and it increases the risk profile of transactions given that investors need to make decisions with a larger number of unknowns. Higher risk profiles increase the cost of financing and limit access.

Regulation that provides certainty around the pace and scale of ZET adoption is foundational to create a supportive environment at the country level that encourages investment. Leading examples in this arena are California's Advanced Clean Trucks rule and the European Commission's Heavy Duty Vehicle CO2 Standards (currently under revision), as they compel vehicle manufacturers to ramp up production at the scale and pace required by the climate crisis. These regulations align all market players around a common goal and timeline, giving certainty to the transition which in turn reduces the risk profile of investments and lowers the cost of finance. Supply side mandates are a critical tool that governments in LAC should promulgate to develop an ecosystem that allows ZETs to thrive.

CHAPTER 3

3. ROLE OF FINANCE TO ACCELERATE ZET ADOPTION

3.1 CURRENT TRANSPORT OPERATOR PROCUREMENT MODELS

Given the high upfront cost of ZETs, widespread access to affordable financing solutions will be determinate to scale up adoption. However, the need for finance is not exclusive to zero-emission technologies, as current ICE procurements already rely heavily on loans, and to a lesser degree on leases, particularly among formal companies (see Table 6).

Table 6. Truck Acquisition Model Penetration by Country for the Formal Sector

Procurement Model / Countries	Colombia	Chile	Uruguay	Mexico	Caribbean
Cash Purchase Full payment of the unit cost	2	2	3	2	2
Loan Payment in installments over a period with interest	4	4	4	4	4
International Cooperation Financing with international banks	3	4	2	3	1
Leasing Temporary use of vehicles under contract	4	2	2	3	2

Note: The numbers describe the level of penetration of the type of business model, where 1 is null and 5 is high.

□ 1 Null penetration □ 2 Little penetration □ 3 Medium penetration □ 4 High penetration

Source: E-Mobilitas elaboration, derived from interviews in the different LAC countries.

Colombia’s national government has implemented a fleet renewal policy [66] for freight transportation, stipulating a maximum operating age of 20–25 years, after which the vehicle must be retired from service. In this country, leasing arrangements are commonly preferred over vehicle purchases due to the significant tax advantages they offer: they allow businesses to deduct a portion of their lease payments as business expenses, lightening the tax burden. Furthermore, they require lower initial down payments, freeing capital for other investments. The fixed monthly payments under a lease facilitate budgeting and are ideal for those looking to frequently update vehicles without concerns about asset depreciation. For small owner-operators seeking to purchase a vehicle in Colombia, Bancóldex offers loans of up to 600 million Colombian pesos (\$152,000 USD) for vehicles weighing at least 10.5 tons, with repayment terms of up to seven years. The program expects to support scrappage of up to 30,000 vehicles. For this Bancóldex program [67], the acquisition of new trucks is contingent upon the decommissioning of older units, with the requirement that the new trucks possess similar load capacity.

In Chile, the most recurrent model for transport companies and individual cargo transport operators is the acquisition of new trucks through financing with lower interest rates for established companies. Crédito Transporte from BancoEstado is an initiative that seeks to encourage and support financing for renewal or increase of the truck fleet with monthly, bi-monthly, semi-annual, or annual payments for small business owners. This program contains flexible requirements, among which are: being a small business with an income of up to UF 5,000 per year (~\$202,000 USD) and having one year of seniority as a natural person with commercial activity or being a legal business with at least two years in operation. The program is open only for Chilean nationals (BancoEstado, 2020).

In Mexico, the most common practice for formal companies to acquire a new truck is a five-year loan [14]. For small owner-operators who are unable to access traditional financing alternatives, fleet renewal predominantly occurs through the importation of used vehicles from the United States, typically with an average usage period of 8–10 years. These used units are acquired at a value equivalent to 30–40 percent of the cost of a new unit [14] and tend to be supported by high-interest rate loans that are not designed specifically for the transportation sector. Nacional Financiera (NAFIN), Mexico's National Development Bank, focused on small and medium companies and developed a program to support formal micro and small transportation companies with fleets of 1–30 motor vehicles with financing for the purchase of new and semi-new units through specialized financial intermediaries [67]. The program supports procurement of diesel (Euro V and Euro VI), compressed natural gas, hybrid electric, and battery-electric vehicles. The program does not currently offer preferential terms for ZETs, and its ability to encourage ZET adoption over more affordable ICE alternatives is yet to be seen. However, a new program between the German Development Bank (KfW) and NAFIN will provide preferential interest rates to transport operators who decide to migrate to electric fleets.

The analysis of traditional acquisition models shows that cash purchases are relatively rare in LAC countries. Most fleet owners rely on some form of financing to acquire new vehicles. Larger, formal fleets can access more specialized products and lower interest rates. Smaller, informal fleets face larger barriers of entry and receive worse terms, since many lack good credit scores, cannot offer collateral, face over-indebtedness risk due to lack of financial training, have low profit margins, and have uncertain operating expenses. Moreover, since these fleets typically purchase used vehicles, the cost differential with a new ZET is substantial. Even though specific programs have been developed to support small businesses with their fleet replacements, informality remains a barrier of entry. Additionally, small transport operators interviewed indicated that the possibility of accessing finance is not attractive enough to move them toward formalization; they seek lower than average interest rates and government rebates that can increase economic benefits.

To encourage ZET adoption within the traditional acquisition models, two aspects result from the analysis: 1) the financial products that currently facilitate ICE purchases should not only be inclusive of ZETs but also designed in a way that improves their business case by leveraging their lower operational costs (such as longer repayment periods and lower interest rates), and 2) informal fleets need stronger support and incentives to move them toward the formal sector and allow them to access more convenient financial products.

3.2 FINANCIAL INSTRUMENT ARCHETYPES

The financial solutions that truck fleets rely on for vehicle procurement are typically provided by different types of organizations:

Figure 10. Financial Organizations

Commercial banks	Private-sector financial institutions that accept deposits, offer checking and savings accounts to individuals and businesses, and redeploy this capital through loans and basic financial products.
Captive finance companies	Wholly owned subsidiaries of automakers that provide loans and financial services for the customers of those automakers, such as multiyear vehicle loans.
Leasing companies	Private-sector companies offering vehicles for companies to use in exchange for a fixed or variable fee.
National DFIs	Government-owned specialized development banks aimed at supporting private-sector development in their own countries.
International DFIs	Specialized development banks or organizations aimed at supporting public- and private-sector development in developing countries. (Note: International DFIs include multilateral development banks (MDBs) that pool funding from multiple donor countries, as well as bilateral development banks capitalized by a single government to support development in other countries. Some international DFIs are set up with a sole focus on either public- or private-sector entities as their main client.)

Financial institutions have at their disposal a wide range of financial instruments to accelerate investments. The following table offers an overview of the traditional funding instruments used by finance providers in LAC [68].

Table 7. Financial Instrument Archetypes

Instrument & description		Commercial banks	Captive finance companies	Leasing companies	International DFIs	National DFIs
Standard grants	Non-reimbursable funds to reduce vehicle costs or provide technical assistance				✓	
Standard loans	Loans with a fixed interest rate and level monthly payments over their amortization period	✓	✓		✓	✓
Reimbursable grants	Grants that may have to be repaid to the provider if the program eventually obtains a loan, either from the provider itself or another source				✓	
Green bonds	A type of fixed-income instrument earmarked to raise money for environmental investments; typically asset-linked and backed by the issuing entity's balance sheet, so they usually carry the same credit rating as their issuers' other debt obligations	✓	✓	✓	✓	✓
Guarantees	Seek to improve financing conditions for projects to attract investment by protecting private investors against risks that they are usually not well suited to assess or manage				✓	✓
Subordinated loans	Loans that are repaid after all other forms of debt are serviced				✓	
Vehicle leasing	Offers companies the right to use a vehicle in exchange for a fee		✓	✓		

Source: E-Mobilitas' elaboration based on interviews and document research.

3.3 PRIVATE SECTOR FINANCE

Private-sector financial institutions are beginning to recognize the need to expand their traditional offerings to ZEVs. Traditional finance companies are expanding their portfolio as their authorized automakers incorporate ZEVs to their offerings, with some of these companies expanding traditional vehicle financing to also include charging stations.

Commercial banks and leasing companies are exploring partnerships where innovative financial products are emerging to facilitate the transition to zero-emission technologies. Some of these innovations include issuing green bonds, offering longer repayment periods and discounted interest rates, and creating tailored leasing offerings for electric vehicles where “smart money” is provided (i.e., offering consulting services in the development of their electric mobility projects, coupled with the financing to achieve the project).

The following initiatives have been developed by the private sector to foster the transition—and be a strategic partner of governments—in the replacement of conventional vehicles with electric fleets.

Table 8. Examples of Private Sector Transport Electrification Offerings

Country	Organization	Example
Chile	BancoEstado	BancoEstado offers a credit agreement with the Be-Electric brand to finance bicycles, motorcycles, and cars. It offers a preferential monthly rate, financing of 100% of the value of the vehicle, up to 60-month term, and 90 days grace period for the payment of the first installment. In addition, BancoEstado offers general green credits for individuals and companies that can be used to procure scooters, bicycles, motorcycles, tricycles, hybrid, and electric cars with 100% financing of the vehicle's value and up to a 60-month repayment term.
	Arval BNP Paribas	Arval BNP Paribas offers bundled electrification solutions including electric vehicles, charging infrastructure, and fleet management.
	ALD Automotive	ALD Automotive offers electric two-wheeler leasing under 12- and 24-month terms, inclusive of maintenance, insurance, and driver safety kit.
	Grandleasing	Grandleasing offers operational leasing of electric buses, trucks, vans, and off-road equipment.
Colombia	Renting Colombia	Renting Colombia offers leasing with no down payment, from 60 months onward, and support to sell the fleets current ICE vehicle that the ZEV will replace. Renting also offers quadcycles through a partnership with Muverang.
	Banco Occidente Bancolombia Finandina	Banco Occidente, Bancolombia, and Finandina offer 100% credit financing and leasing with option to buy for electric cars, with terms up to 84 months and discounted interest rates.
	BBVA	BBVA offers 90% for electric motorbikes with terms up to 72 months.
	Banco de Bogotá	Banco de Bogotá offers financing of up to 110% (100% of the vehicle plus 10% in accessories), with 84-month terms and reduced interest rates.
	Enel X	Enel X offers charging-as-a-service for companies interested in electrifying.

Country	Organization	Example
Dominican Republic	Banco Popular	Banco Popular offers 90% credit financing for electric cars with terms up to 84 months and a fixed rate for three years.
	Banreservas	Banreservas offers financing of 80% of the value for personal vehicles and 70% for commercial vehicles.
	BanFondesa	BanFondesa offers sustainable loans for a wide range of energy saving technologies, including electric vehicles, with variable repayment terms and interest rates.
Mexico	VEMO	VEMO offers both fleet-as-a-service and charging-as-a-service for last-mile delivery vans and trucks, regional freight (up to 200 km), and passenger cars.
	Element Fleet Management	Element Fleet Management offers operating leasing services to large transport companies, including project design services and financing for associated charging infrastructure.
	ALD Automotive	ALD Automotive offers bundled leasing and electrification consulting, with charging services provided in partnership with VEMO.
	Santander/BYD	Santander offers up to 90% financing with a 72-month term and 0% origination commission to acquire BYD passenger cars.
	BBVA	BBVA offers up to 65% financing with an 11% fixed interest rate and up to 60-month terms for hybrid and electric vehicles. Additionally, the bank offers up to 95% financing for electric vehicles.
	BBVA/SOLAREVER	BBVA and SOLAREVER (SEV brand) offer up to 95% financing of SEV passenger cars.
	HSBC	HSBC offers up to 90% financing with a 12% fixed interest rate and 1% origination commission.
Uruguay	BBVA	BBVA offers a maximum financing term of 60 months that includes a no-cost account package.
	ITAÚ	ITAÚ bank offers a loan in 36 installments in indexed units ("UI", a monetary unit adjusted daily for past inflation) that includes insurance, brand-provided maintenance service, and the possibility of handing in the unit at the end of the loan and taking a new vehicle.
	HSBC Santander	HSBC and Santander supported the company CUTCSA (public transport operator in the Uruguayan capital) in the purchase of the first 10 electric buses, within the framework of the fleet replacement subsidy.

Source: E-Mobilitas and CALSTART elaboration based on interviews and research of LAC finance products.

This compendium of private-sector offerings shows that the number of financing alternatives for ZEVs in LAC is growing. Mexico, Colombia, and Chile have the largest number of offerings and also include specific offerings for ZETs. These experiences can provide an example for other companies and encourage governments to engage with them and explore the regulatory framework needed to attract increased investment and expand their offerings to harder-to-reach segments (such as smaller owner-operators). Except for the Dominican Republic, all the Caribbean islands analyzed offered only short-term electric vehicle rentals aimed at tourists.

Electrification-as-a-service (and some leasing arrangements) have huge potential to scale up adoption, as shown by the enormous market penetration that Enel X and Element Fleet Management have had in Latin America. These products can accelerate the learning curve for fleets by providing turnkey solutions; they can be structured around long-term contracts that maximize operational savings and can reduce risks for fleets such as vehicles' uncertain residual value.

Outside of the LAC region, companies are developing other innovative business models that play to the advantages of ZETs and may provide a pathway for replication. Zeem Solutions (U.S.) offers companies a bundled lease that includes project planning, vehicle, maintenance, inspections, and cleaning services, as well as access to parking and charging at a shared depot owned by Zeem. By removing the charging installation piece from the equation, Zeem simplifies the process, accelerates deployment timelines, and can offer solutions to fleets with limited access to parking. Zeti, Inc. (U.K., U.S.) is a unique fintech company connecting investors and fleets to accelerate the transition. Their platform allows capital providers to invest in ZEVs as a new asset class, with transparency and risk-adjusted returns, similar to what has been done previously with renewable energy investments. For fleets, it allows them to access ZETs using a pay-per-mile scheme which eliminates the upfront cost barrier and optimizes cashflows. A final useful example comes from IKEA's partnership with Fluid Truck (U.S.). Fluid provides ZETs as short-term rentals to third-party carriers delivering for IKEA, which allows them to access ZETs without the upfront cost. IKEA ensures carriers are renting vehicles from Fluid, which gives Fluid the demand certainty needed to purchase the vehicles. These examples illustrate alternative approaches that could inform the expansion of financial offerings in LAC for ZETs, while showing potential pathways to include small owner-operators in the transition.

3.4 INTERNATIONAL DFIs' ROLES AND FUNDING ALLOCATION PROCESSES

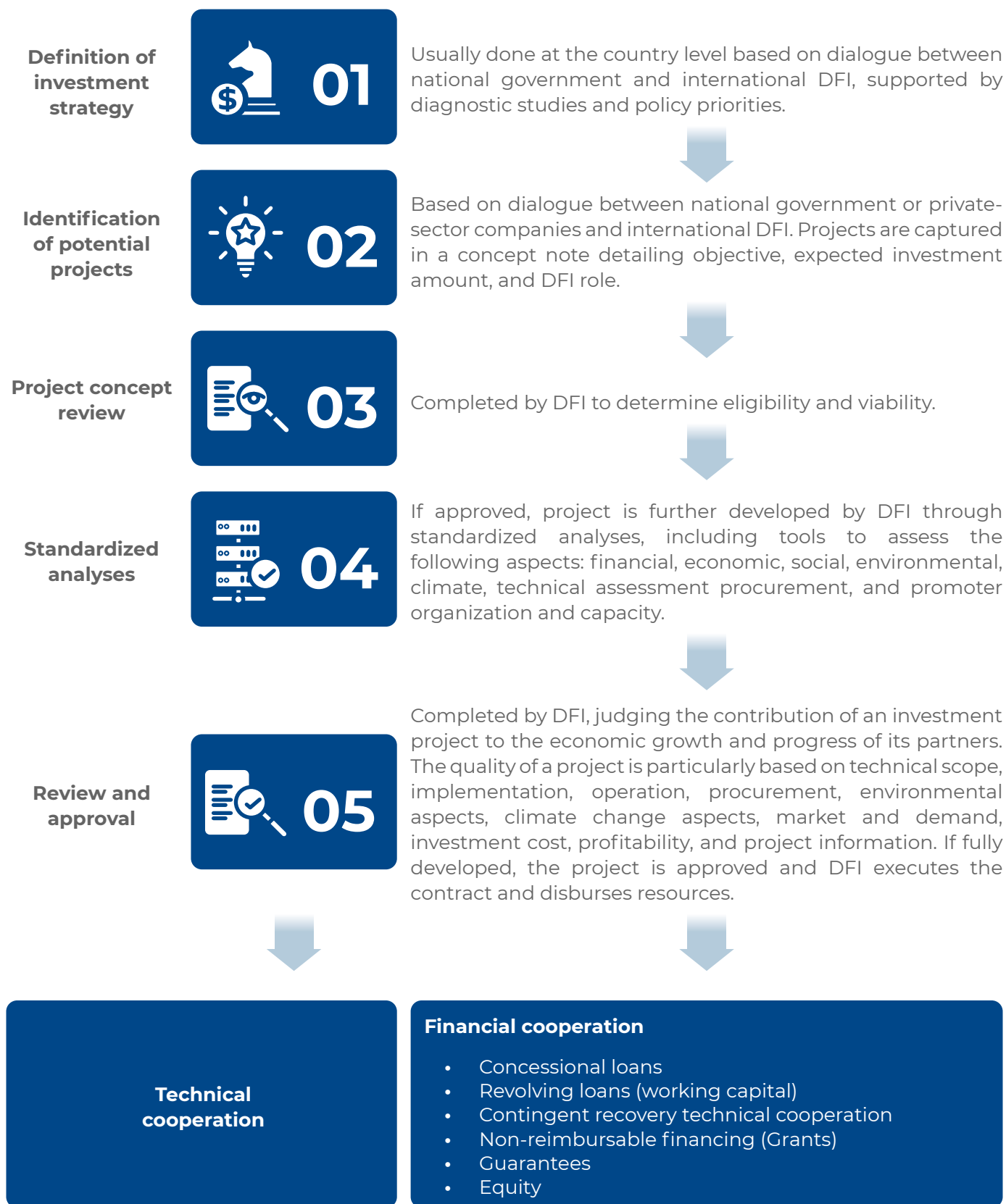
The bilateral and multilateral development system is not only an advocate for development but also an innovative force in the financial realm. Development organizations provide a diverse array of financial instruments that can be customized to suit the unique requirements of countries and economic segments at various stages of development. Some experiences, such as those provoked by the COVID-19 pandemic, have shown that development banks have the capacity to continue operating internal markets despite economic adversities and are critical for the construction and development of productive capacities in the countries. DFIs are uniquely positioned to fill the financing gaps that public funding is unable to cover, serve segments of the population not properly covered by the private financial sector, accelerate market maturity where private-sector investments are limited, and mobilize other sources of public and private financing.

There are two main types of international DFIs: a) public-sector focused and b) private-sector focused.

- a.** Public-sector focused DFIs are those who contract directly with government agencies in recipient countries, such as World Bank, Inter-American Development Bank, Development Bank of Latin America and the Caribbean (CAF), and KfW. The projects they finance may also support private-sector development, but they tend to do so through public agencies (for example, by issuing a sovereign loan to a national development bank, who then offers smaller loans to the private sector).
- b.** The private-sector arms of MDBs, such as IDB Invest (IDB Group) or IFC (World Bank Group), are DFIs committed to promote economic development by contracting directly with private-sector companies or public-private partnerships. These banks finance private-sector activities in countries and sectors where conditions are not conducive to private investment. They help companies in these countries obtain financing in capital markets and provide technical assistance to strengthen their economic prospects.

The typical process followed by international DFIs to execute a project is summarized in Figure 11.

Figure 11. Typical International DFI Funding Allocation Process



Sources: IFC, World Bank, IADB [69], [70], [71]

The steps outlined above, which are traditionally employed by MDBs for allocating financial resources, serve the purpose of mitigating various risks, particularly by incorporating environmental and social assessment of projects to prevent or minimize potential harm to the environment and communities. In response, local development banks have established their own environmental and social management systems to adhere to these requirements and secure financing.

The situation is different, however, for private-sector finance institutions and companies in the transport sector. For these, specialized evaluations for projects can discourage credit applications and impede the development of new markets, as they create a perception of increased workload and financial costs for applicants. Therefore, it is crucial for DFIs to consider the constraints that applicants may face and collaboratively commit to working with applicants to understand, adopt, and develop their own environmental and social risk management system as a mitigation tool.

The environmental and social analyses established by MDBs are reinforced by safeguards, which represent a specialized set of regulations employed by MDBs that borrowing countries must adhere to when utilizing MDB resources for a development project. These regulations, which go beyond the laws and regulations of the borrowing countries, aim to mitigate and address any adverse impacts the project may have on the environment or vulnerable social groups. All planned projects in developing countries and emerging economies, as well as export and project financing, are subjected to an environmental and social impact assessment, following international standards such as the World Bank’s Environmental and Social Standards or, in certain cases, the Equator Principles (i.e., set of guidelines for commercial banks that support the management of social and environmental issues in connection with the financing of development projects).

3.5 INTERNATIONAL DFI PROGRAMS AND POTENTIAL

In the LAC region, development banks are showing increasing interest in transitioning to electric mobility and aligning capital to spur adoption. This is particularly noticeable in the public transport segment, with comprehensive efforts targeted at accelerating adoption of zero-emission buses. The following table shows all identified projects that support ZEV deployments in the countries analyzed. The research included project databases and websites of the Green Climate Fund (GCF), Global Environmental Facility (GEF), World Bank, Inter-American Development Bank (IADB), IDB Invest, KfW, Development Bank of Latin America and the Caribbean (CAF), North American Development Bank (NADBank), Caribbean Development Bank (CDB), Agence Française de Développement (AFD), and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in conjunction with KfW Bankengruppe.

Table 9. Development Bank Transport Electrification Offerings

Country	Organization	Example
Regional	IADB / GCF	The “E-Mobility Program for Sustainable Cities in Latin America and the Caribbean” is the first regional fund to promote electric mobility and the use of green hydrogen in Latin America and the Caribbean. The fund is providing \$450 million USD in concessional loans and grants to nine countries (Barbados, Chile, Colombia, Costa Rica, the Dominican Republic, Jamaica, Panama, Paraguay, and Uruguay) to assess feasibility of hydrogen and vehicle-to-grid technologies to increase grid resilience; deploy 470 electric buses and 250 e-taxis; and strengthen policy development, among other activities [72].
	CAF / GCF	The “E-Motion: E-Mobility and Low Carbon Transportation” program was developed to support the governments of Panama, Paraguay, and Uruguay to promote adoption of electric buses and passenger cars. The total project value is \$231 million USD delivered through grants, loans, equity, and in-kind co-financing. It includes three main components: 1) technical assistance to establish a favorable business and public policy framework for the widespread adoption of electric vehicles; 2) financing for the procurement of large-scale electric bus fleets; and 3) deployment of extensive and gender-sensitive fast-charging infrastructure [73].

Country	Organization	Example
Chile	IDB Invest / IFC	IDB Invest [74], [75] and IFC issued loans totaling \$304 million USD for the purchase, operation, and maintenance of 992 electric buses by Suministradora de Buses K Cuatro Spa, a joint venture between Inversiones Kaufmann and Enel X. The buses will operate with a 14-year concession in Santiago's public transit system. Through this project, Chile achieved the milestone of having the largest fleet of electric buses in the world outside of China.
	GEF / UNEP	The “Accelerating the Adoption of Electric Mobility in Chile” is a project to support stakeholder engagement; a demonstrative deployment of six fixed-route taxis; development of financial instruments and business models to support fixed-route taxi electrification; and training for waste companies on used vehicle and battery reuse, recycling, and disposal. The project was set up with \$1.8 million USD in GEF grant funding, with \$18.5 million USD in co-financing through equity, grants, and in-kind contributions [76].
	GEF / CAF	“Supporting the Chilean Low Emissions Transport Strategy (CLETS)” project deployed \$2.9 million USD in GEF grant funding and \$37.6 million USD in cash and in-kind co-financing to strengthen zero-emission strategy and regulation, deploy zero-emission buses and taxis, and improve pedestrian and cycling infrastructure [77].
	GIZ / BMUV	“Moving Chile: Upscaling electric mobility in Chile” technical assistance project will support the development of financing mechanisms to promote adoption of electric buses and taxis in Chile, including capacity building and pilot deployments (Grant amount not identified) [78].
Colombia	IDB Invest	IDB Invest, Enel X, and <i>InfraBridge</i> executed a project to promote electric mobility in the city of Bogota, Colombia. The financing consists of two senior loans granted to companies specially created for the project (special purpose vehicles) by ENEL X, a business line of Enel Colombia, and <i>InfraBridge</i> . The loans total an average of \$134 million USD, co-financed by IDB Invest, UK SIP, and BNP Paribas [79], and were used to finance 401 electric buses.
	IDB Invest	Through separate transactions using syndicated loans and guarantees , IDB Invest has financed electric bus procurement projects of 259 vehicles by Electribús Bogotá USME (\$26 million USD) [80], 229 buses and charging infrastructure by Usme ZE (\$28 million USD), and 172 buses and charging infrastructure by Fontibón ZE (\$25 million USD).
	IDB Invest / Bladex	IDB Invest, ILX, and Bladex developed a financial package with two disbursements: a loan of about \$25 million USD by IDB Invest and another of \$35 million USD to be financed through the sale of shares to private banks. The beneficiary, Finanzauto S.A. BIC, will expand its financing offerings to micro, small, and medium-sized enterprises, with between 7–10% of this amount being allocated to electromobility [81].
Mexico	IFC	IFC invested \$400 million USD in the form of senior loans to support ALD automotive, a leading global vehicle leasing company and subsidiary of Société Générale. The investment is expected to add 15,000 low-emission vehicles (hybrid, plug-in hybrid, and battery-electric) to ALD's fleet across Mexico, Turkey, India, Serbia, Romania, Bulgaria, and Croatia.
	IFC	IFC provided a \$116.5 million USD long-term loan to BBVA Leasing to provide leasing and green finance offerings to small and medium enterprises in Mexico. The program offers financing for Euro V and VI diesel vehicles, CNG, and battery-electric [82].
	GIZ / IKI / BMWK	“Transition Towards an Integrated, Accessible and Smart Public Transport System in Mexico (TranSIT)” Program will support the development of intelligent, inclusive, and climate-friendly transport systems, inclusive but not limited to the deployment of electric buses, with grants and technical assistance valued at close to \$6 million USD [83].

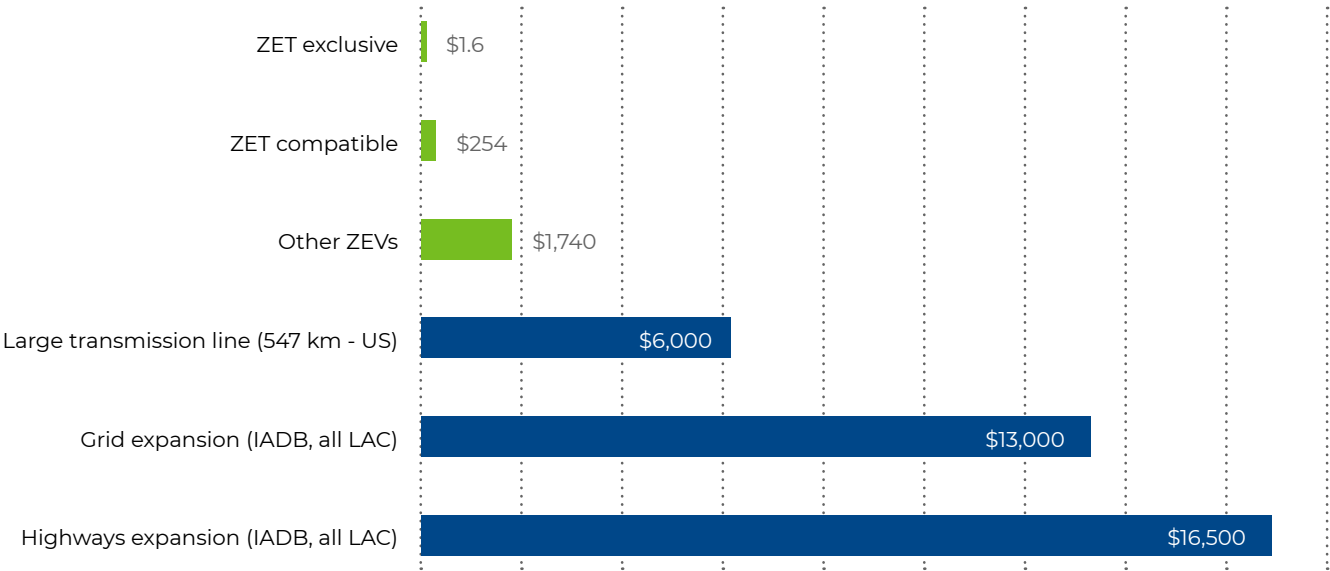
Country	Organization	Example
	NADBank	NADBank and the governments of Arizona and Sonora are developing a joint first-of-its-kind, cross-border truck electrification pilot project to connect both Nogales (U.S.–Mexico). The project's scope includes three electric drayage trucks and charging infrastructure on both sides of the border, supported by an initial \$350,000 contribution in seed funding by NADBank and a \$1.5 million USD grant application by Nogales Port Authority [84].
	NADBank	NADBank issued a \$20 million USD line of credit to Liquidez Corporativa, a Mexican financial institution, to fund lending operations to micro-, small-, and medium-sized enterprises for green projects located within 300 kilometers of the U.S.–Mexico border, including investments in electric vehicles as well as high fuel efficiency vehicles [85].
	NAFIN / KfW	Through its Sustainability Fund, KfW is supporting Mexico's national development bank NAFIN through a \$110 million USD development loan and an \$11 million USD investment grant to support small and medium enterprises to replace their vehicles with cleaner models. NAFIN's offerings include a scrappage bonus (using the grant funding) and a long-term loan. The project supports acquisition of taxis, pickups, vans, and trucks up to 5 tons. Vehicles can be electric, hybrid, or diesel (Euro V and Euro VI) [86] [87]. Implementation varies across states, and the version of the project for Mexico City, which is focused specifically on taxis, aims to restrict bonus eligibility to electric and hybrid vehicles [88], eligible for bonuses of about \$10,000 USD and \$8,000 USD, respectively.
Dominican Republic	IADB	"Eco-Delivery: electric mobility, environment, and intelligence" project is aimed at reducing air pollution, noise pollution, and accident rate by replacing 260 combustion engine two-wheelers with electric ones through a business model that allows businesses to reduce operating costs by 75%, paired with training and monitoring systems. The project is valued at \$1.5 million USD, with 50% provided as technical cooperation and 50% co-funding from the government [89].
Uruguay	GEF / UNDP	"MOVÉS - Hacia un Sistema de movilidad urbana sostenible y eficiente en Uruguay" project was aimed at strengthening institutional capacity and regulation for low-emission transport, improving monitoring and communication, and launching pilot deployments of electric buses and vans under new business models. The project resulted in the adoption of 32 electric buses, with a total funding of \$21 million USD in grants and national government co-funding [90].

Source: E-Mobilitas and CALSTART elaboration based on multiple sources of information.

Note: Only projects resulting in electric vehicle deployments have been included. Other related international DFI projects focused specifically on technical assistance and knowledge sharing include: Advancing a regional approach to e-mobility in Latin America (UNEP, GCF); Facilitating the Development of Ambitious Transport Mitigation Actions – TRANSfer (GIZ, IKI, BMWK); Accelerating NDC Implementation – Unlocking Clean Buses in LAC (IADB); Transformative Urban Mobility Initiative E-Bus Mission (BMZ/GIZ and implementing partners); Transit Oriented NAMA (KfW), Climate change transport in Colombia: intermodality and new technologies (IADB); Implementation of Sustainable Mobility in Colombian Cities (IADB); Sustainable Urban Transport in Colombian Cities (IADB); and Program to support regional public transport and road safety in Chile (IADB).

The following chart shows the order of magnitude of investments in ZEVs over the past five years, based on the latest reports published by MDBs with the largest presence in the region (World Bank, IADB, IDB Invest, CAF) [81], [91], [92], [93]. To put the investment magnitude into perspective, ZEV investments are compared with other investments in related sectors.

Figure 12. Investments in ZETs, ZEVs, and Related Sectors (2018-2023)



Source: E-Mobilitas and CALSTART elaboration based on multiple sources of information.
Note: IADB highway and grid investment estimations are based on the “Committed Amount (USD)” for projects approved between 2019 and 2023 as shown in IADB’s downloadable Project Information spreadsheet. Grid expansion investments include the following Project Sub-sectors: new power distribution & transmission projects; rural electrification; and energy integration. Highway investments include the following Project Sub-sectors: major highways, road maintenance, road safety, rural roads, and secondary roads. The large transmission line refers to the Champlain Hudson Power Express line connecting Quebec, Canada, to New York City, United States.

The main conclusion drawn from this assessment is that ZETs are considerably underrepresented in international DFI investments. As evidenced in both the table and chart above, international DFIs are playing a major role in accelerating adoption of zero-emission technologies for passenger vehicles, with a focus on public transportation. However, out of all the projects identified, only one (by NADBank) included a direct deployment of ZETs; four more (1. Nafin/KfW; 2. IFC; 3. IDB Invest / Bladex (10%); and 4. GEF/UNDP) were open to funding of ZETs but also other vehicles (three of these supported ICE trucks, which raises questions about their ability to encourage ZET uptake without substantial preferential treatment). Investment earmarked for ZETs represented 0.08 percent of the total investment in ZEVs and 0.001 percent of the investment in highways. The fact that ZETs are being deployed in LAC without substantial support from international DFIs speaks to the potential of the market and private sector’s appetite for the technology, which can be vastly accelerated if the experience that international DFIs have gained in the public transport segment is effectively expanded to freight.

Additionally, investments in zero-emission mobility are still a relatively small area of investment for most international DFIs. As shown in the graph above, all zero-emission transport projects identified amount to \$1,996 million USD in total investment mobilized. These represent a fraction of total investment directed at other related sectors, such as highways and electrical grid infrastructure expansion. Using IADB as an example, funding committed by IADB alone in highway and road maintenance and expansion over the past five years amounted to over \$16.5 billion USD across LAC. Similarly, investments by IADB in grid expansion (via energy integration, rural electrification, and new power distribution and transmission projects) represented over \$13 billion USD [94]. These investments offer a unique opportunity to support ZEV adoption, since ZEVs will require publicly available charging infrastructure along highways and grid infrastructure with sufficient capacity to satisfy their charging needs, both at publicly available charging stations and (more importantly) depots. International DFIs are in a position to ensure highway and grid expansion investments consider the needs of ZEVs and can be future-proofed to avoid sunk costs later down the road.

While currently not supporting deployments in the countries analyzed, the Global Facility to Decarbonize Transport (GFDT) [95] deserves attention as a promising World Bank initiative to accelerate decarbonization on the global stage. Announced during the Conference of Parties (COP) 26 (2021), GFDT pools resources from donor countries to pilot innovative new approaches to finance the transition. The funding pool is still small, with its first awards totaling \$3.5 million USD for seven projects and an initial target to mobilize \$200 million USD to support emerging economies. In contrast, California alone has invested over \$800 million USD to facilitate zero- and low-emission vehicle procurements through its Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program (HVIP). With appropriate support, GFDT could act as an umbrella program to finance transport decarbonization. U.S. experience with ZEV incentive programs has shown that set-aside funding pools and increased incentives for early-stage segments (such as long-haul trucking and small fleet electrification projects) can be an effective way to ensure progress is achieved across all priority areas. A similar approach may be helpful to ensure ZETs are supported by international DFIs in addition to current investments in passenger buses.

3.6 ZET FINANCING SOLUTIONS

Advanced markets like the United States, China, and many European countries are leading the transition to ZETs by utilizing public spending to buy down the cost of technology adoption. Large programs to deploy publicly available charging infrastructure, offer voucher incentives to cover high vehicle costs, and subsidize vehicle production have been effective in these markets. In the LAC region, where public spending is more limited, development banks can effectively deploy concessional funding and de-risk and mobilize private investments to achieve some of the same outcomes.

The table below compiles a selection of financing solutions and government programs that could be deployed in the region through partnerships between international DFIs and national DFIs or private-sector entities to reduce the upfront cost barrier of ZET adoption. Each solution is qualified in terms of 1) its efficacy to operate with a limited level of grant funding, 2) the compatibility of this solution with previous investments made by international DFIs, and 3) the degree of alignment it has with overcoming the upfront cost barrier. Many solutions have been taken from an analysis by the Green Finance Institute [96] and adapted to the context of ZETs in LAC.

Table 10. Financing Solutions and Government Programs

Solution	Overview	Efficacy	Compatibility	Alignment
Subsidized Loans	Low-cost loans for ZETs, supported through concessional loans from international DFIs to commercial banks or national DFIs, who in turn loan to final fleet owners. Loans to end users can offer longer repayment periods and may encompass infrastructure costs.	High	High	High
Focused Subsidized Loans	Low-cost loans for used ZETs targeted at lower income groups and informal fleets, paired with formalization support and targeted outreach campaigns.	Medium	Low	Medium
Residual Value Guarantees	A mechanism that establishes a guaranteed end-of-lease value for a vehicle, thus providing a minimum value to which the vehicle depreciates. Under this mechanism, funding is disbursed only in cases where the actual value is lower than the one established in the guarantee. The price of the battery and chassis sold separately can provide a basis for the residual value floor that a conservative guarantee should cover.	High	Medium	Medium

Solution	Overview	Efficacy	Compatibility	Alignment
Loan Default Guarantees	A mechanism that covers potential losses for a lender in case the borrower is unable to repay the loan. By focusing on small owner-operators with difficulty accessing finance, these guarantees can encourage private-sector lenders to lend to a wider audience and/or offer preferential terms due to reduced risk.	High	Medium	High
ZEV Futureproofing Across Investment Portfolio	Modification of standard project review processes to ensure that all international DFI projects related to highway and grid infrastructure expansion consider the needs of ZEVs. This would allow, for example, new highways to be built with charging plazas every 50 miles or new transmission lines to be right-sized accounting for future demand from ZEVs.	High	High	Medium
ZEV Mainstreaming Across Investment Portfolio	Modification of standard project review processes to ensure that all international DFI projects that lead to vehicle procurement only support ICE adoption if no ZEV alternative is viable. This would ensure, for example, that a loan to expand airport facilities includes the procurement of electric buses instead of ICE buses (concept proposed by the Bank Information Center).	High	High	Low
Data Collection and Research Improvement	Lack of data availability increases investment risk and thus the cost of finance. By ensuring data is available on fleet operations, grid sufficiency, and long-term adoption plans, governments and DFIs can help investors better estimate risk and price it appropriately, while at the same time giving private-sector companies a better way to estimate market potential for expansion.	Medium	High	Medium
Bundled Finance Solutions	Low-cost loans, equity, or green bond issuance to support bundled vehicle/infrastructure finance packages, which enable fleets to make one monthly payment for vehicles, charge points, energy supply, and associated infrastructure (such as solar panels and onsite storage).	High	High	Medium
Transport Funding Facility	A public/private facility to de-risk investment in charging infrastructure and ZET acquisition where there remains market failure. The facility includes guarantees or cornerstone funding from public agencies or international DFIs that effectively mobilize private capital to increase the scale of investment.	Medium	High	Medium
Implementation Toolkits and Advice	Best practice frameworks, tools, and tailored technical assistance to help fleets navigate the electrification process and access financial solutions available on the market. Concessionality can be reduced through means-tested fees on services provided.	Low	High	Medium
Demand Aggregation	Procurement framework to enable fleets to aggregate demand and tender larger scale charging infrastructure and ZET procurements, thus obtaining preferential pricing due to economies of scale and allowing for the installation of shared depot charging infrastructure.	High	Medium	Medium
Community Municipal Investments	Crowdfunding approach to create an efficient, scalable, and cost-effective source of funding for local authorities to finance capital expenditure on local charging infrastructure.	Medium	Low	Low

Solution	Overview	Efficacy	Compatibility	Alignment
Utilization-Linked Loans	Loans for charge-point operators, local authorities, and small businesses repayable based on utilization. In a similar way to student loans, repayments would not commence until a base utilization was achieved, which would likely be later for rural change points.	Medium	Low	Low
Property-Linked Finance	Enables building owners to access 100% upfront funding to install EV change points through finance attached to the property. The responsibility for repayments remains with the property and is passed on to subsequent owners who are benefitting from the charge point. This model is based on the success of Property Assessed Clean Energy (PACE) financing in the United States.	High	Low	Medium
Investor Showcase	An interactive knowledge hub to help connect businesses seeking investment to knowledgeable investors looking for investment opportunities.	Medium	Medium	Medium
Municipal Bonds	Debt instruments issued by public entities engaged in medium- and heavy-duty vehicle fleet electrification that entitle creditors to interest “coupon” payments. These can enable public entities to raise capital to finance large upfront costs for municipal projects.	Medium	Medium	Low
Financial Grants	Direct transfers to fleets or owners that reduce the purchase price of new vehicles and/or infrastructure by covering part of the capital cost of new assets. Direct grants have been used frequently in the past but exhaust public capital quickly, and so are best used in a targeted way to prioritize deployments in overburdened communities and support investment when other financing approaches are not available or practical.	High	High	High
Building Secondary Markets	Building secondary markets for vehicles and batteries, through commitments to purchase assets or the provision of other incentives for the private sector, that would reduce uncertainty and risk around residual values of assets.	Low	Low	Low
Battery Health Programs	Battery health programs that monitor electric medium- and heavy-duty vehicle battery performance, rectify performance issues and/or replace faulty or under-performing batteries, and reduce uncertainty and risk around battery performance and residual values of assets.	Medium	Medium	Medium

Source: Adaptation of analysis based on the Green Finance Institute / Environmental Defense Fund [97].

Note:

- **Efficacy:** *low* (relies on large grants to be established and continue operating), *mid* (relies on grants to be established, but once established it is financially self-sustainable), *high* (relies on preferential borrowing terms and de-risking with limited concessionality)
- **Compatibility:** *low* (no similar efforts have been identified in DFI databases), *mid* (DFIs have used a similar solution for a non-transportation sector), *high* (DFIs have used a similar solution for the transportation sector).
- **Alignment:** *low* (the solution strengthens the ecosystem but does not directly tackle the upfront cost barrier); *mid* (the solution increases access to finance OR reduces the cost of finance); *high* (the solution increases access to finance AND reduces the cost of finance).

The assessment of potential financing solutions shows a wealth of alternatives to accelerate the market, with many offerings promising returns on concessionality while remaining compatible with standard investment practices by international DFIs. *Loan default guarantees* and *focused subsidized loans* show promise as solutions to increase access to affordable finance for small owner-operators who are typically excluded due to lack of credit history and informality. *Demand aggregation* and *transport funding facility* have the potential to mobilize private-sector capital to support large projects by early adopters, such as international companies with ambitious environmental, social, and governance (ESG) commitments. They can also help small fleets and small countries achieve a scale of demand that gets attention from OEMs and helps them access the benefits of discounted procurement. *Residual value guarantees* seem particularly promising when paired with bundled finance solutions or leasing services, since they mitigate the uncertainty of a vehicle's value after its first useful life, leading to a lower amount of the vehicle that needs to be financed and thus a lower price on the lease.

The analysis also brought up two opportunities to ensure ZEV adoption is supported throughout international DFI portfolios, instead of only as part of transport investments. By strengthening existing project review practices and systematically identifying opportunities to future-proof highway and grid infrastructure, DFIs can help governments and utilities avoid sunk costs and ensure charging infrastructure is not a barrier for future adoption.

In conclusion, the search for and adoption of new alternatives to promote the financing of electric trucks is essential to achieve a faster and more effective transition to more sustainable mobility. The opportunities presented by innovative financial instruments not only alleviate initial financial concerns but also reduce perceived risks and encourage investment in cleaner technologies. Taking advantage of these options unlocks a crucial flow of capital that can accelerate the electrification of truck fleets, benefiting the environment by reducing pollutant emissions and improving air quality, unlocking long-term savings in terms of operating and maintenance costs, and driving innovation in the transportation sector.

It is critical to work collaboratively, bringing together governments, financial institutions, vehicle manufacturers, and private-sector players to design and execute strategies that make ZET financing accessible. Investing in these alternatives builds not only a more sustainable and resilient future but also fosters job creation, boosts competitiveness, and lays the foundation for a more efficient and carbon-free transportation industry.

CHAPTER 4

4. CONCLUSIONS AND RECOMMENDATIONS

The transportation sector in LAC plays a vital role in economic development, but it also poses significant challenges in terms of emissions and environmental impact. Helping fleets transition to ZETs presents a compelling solution to mitigate the sector's negative environmental footprint while creating opportunities for economic growth, resilience, and job creation. Despite the proven benefits and successful examples of ZET deployments in the region, cost and financing barriers have hindered widespread adoption.

This white paper has identified some of the key challenges that need to be overcome to expand access to financing for ZETs in the region, including insufficient transmission and distribution grid infrastructure, prevalence of informality in the sector, deficiencies in freight transportation data, and most importantly, the lack of regulations that lock in a timeline for the transition. Overcoming these challenges will require close cooperation between DFIs, governments, private-sector financing institutions, fleets, and manufacturers. By adopting regulation that mandates ZET uptake, governments can create a fixed timeline that brings all market players to the table and ensures collaboration happens at the speed required.

Due to resource constraints and a larger pool of development needs, governments in LAC may not be able to offer the same level of incentives that governments in developed economies are using to accelerate the market. International DFIs are well positioned to help overcome this challenge by strategically deploying concessional funding that can make electrification more affordable and inclusive across LAC.

To accelerate the adoption of ZETs by unlocking access to affordable financing products, the authors propose the following recommendations to **international DFIs**:

- 1. Increase concessional funding for ZETs and charging infrastructure, leveraging lessons learned from electric bus projects.** LAC is a global leader in zero-emission bus deployment, in no small part because of projects that have successfully deployed concessional funding to structure bankable projects and de-risk private investment in bus electrification. The truck segment needs a similar kind of support. While some mechanisms may need to be adapted to service the freight market, many bus projects are already focused on private-sector companies and public-private partnerships, which allows for higher transferability to the freight segment. The “E-Mobility Program for Sustainable Cities in Latin America and the Caribbean” and “E-Motion: E-Mobility and Low Carbon Transportation” can serve as templates for expansion or replication in the truck segment. Additionally, GFDT can increase its focus in the truck segment, help set up regional facilities, and launch demonstration projects in early markets. Increasing investments in ZETs should be paired with barring the use of concessional funding for fossil fuel-based deployments in segments where zero-emission technologies can offer a viable alternative.
- 2. Accelerate large fleet electrification through bundled solutions, residual value guarantees, and facilitation of procurement at scale.** In the LAC countries analyzed, large fleets represent 1 percent of companies, controlling 28 percent of vehicles on the road. These companies tend to have access to commercial financing products, and many have ESG commitments, which positions them as potential early adopters of ZETs. International DFIs can accelerate electrification of these fleets by improving the business case of ZETs. This analysis highlights three potential financing solutions to consider:

- a. **Residual value guarantees:** Given the lack of data on ZET residual values, risk-averse leasing providers tend to assume vehicles will be worth very little after their leasing term and assign conservative values, which increases the cost of leasing for fleets. DFIs' experience with guarantees could support captive finance providers and leasing companies to partially mitigate this risk and lock in more positive residuals that lower the cost of leasing. The secondary market for batteries is growing, and established second life pricing for these components, alongside already established chassis pricing, can provide a baseline for the residual value floor that ZETs can be expected to have. The capital intensity and concessionality of this approach can be low, and disbursements are made only if vehicles depreciate beyond the amount covered by the guarantee.
 - b. **Demand aggregation:** Small, fragmented procurements are more expensive for fleets and can often fail to meet the transaction size required by many DFIs and private investors. By facilitating demand aggregation efforts, DFIs can lower the cost of vehicle procurement through economies of scale, increase the pool of potential financing providers, unlock the potential of shared charging infrastructure around freight clusters, allow utilities to right-size grid infrastructure expansion, and send a strong market signal to OEMs that accelerated production is needed. The capital intensity of this approach is low and can be supported through technical assistance offerings.
 - c. **Bundled finance solutions:** As-a-service business models that bundle together all the costs of electrification, including vehicle and infrastructure CAPEX and OPEX, have proven to be the preferred electrification model for many large fleets in LAC. Since ZETs are cheaper to operate than ICE trucks, higher utilization typically improves their business case. DFIs can support companies providing bundled solutions by offering long-term loans that can be passed on to customers, allowing them to enter long-term agreements that maximize operational savings and thus reduce TCO. The capital intensity of this approach is larger, although concessionality can be lower.
3. **Ensure new investments in highways and grid infrastructure expansion are future-proofed to meet transport charging demands.** Most countries in the region have committed to carbon neutrality by 2050 or 100 percent ZEV sales by 2040. The fleet of the future will be largely battery-electric and as such will require a robust, carbon-free electricity grid and publicly available chargers to satisfy charging needs along highways. DFIs invest heavily in highway and grid expansion, which presents an opportunity to ensure that these investments consider future electric vehicle charging needs. Through a standardized assessment of new highway investments, DFIs could promote charging station buildout at appropriate intervals, ensuring all new highways are ZEV-supportive highways. Through similar assessments, based on long-term grid infrastructure plans co-developed by utilities and governments, DFIs can ensure that new grid expansion projects are sized correctly and able to satisfy transport electricity demand in the long term. Long-term grid infrastructure plan development can be supported by DFIs through technical assistance.
4. **Support financial inclusion of small owner-operators with tailored financing solutions.** In the LAC countries studied, over half of the truck fleet is controlled by micro and small owner-operators, typically working in the informal sector. Since these companies tend to have the oldest, most polluting vehicles, supporting their transition is critical not only from an equity perspective but also due to climate, air pollution, and health impacts. At the same time, the challenges to decarbonize this sector are particularly acute given the drastic cost differential between a new ZET and a used ICE truck, which is the typical purchase of choice for most small owner-operators. This analysis highlights the following interventions to address the segment:
- a. **Non-refundable incentives paired with subsidized loans:** Since TCO parity between new ZETs and used ICE trucks is unlikely to materialize, grant funding paired with long-term, low-cost financing will be needed to offer an ownership-based procurement solution that is attractive for small fleet operators. DFIs can support investments of this kind, as KfW has done in Mexico, working with NAFIN to provide scrappage incentives and loans for vehicle replacement. Formalization support and targeted outreach campaigns may also be needed to successfully address the segment.

- b. Bundled finance solutions paired with demand aggregation:** Leasing and as-a-service offerings can offer the same cash flow benefits to small fleets as they do to large fleets. Business models like those used by Zeem Solutions and Fluid Truck in the United States are designed to electrify this segment by aggregating local demand and offering term flexibility and can be supported by private-sector focused DFIs through equity, bonds, and loans.

To the same end, the authors propose the following recommendations to **national governments**:

- 1. Reduce market uncertainties through regulation, standardized data collection, and planning to shape the market in the mid to long term.** Private-sector investors interviewed during this research highlighted that investment decisions are based on trustworthy assessments of potential risk-adjusted payback. If data is unreliable or outdated, or if there is no clear sense of what a market will look like in a few years, there is higher uncertainty around an investment opportunity. This uncertainty makes the investment riskier and in turn demands more attractive returns. Supply-side mandates (such as California's Advanced Clean Trucks regulation) are a highly effective tool to ensure adoption and provide mid- to long-term market certainty. Additionally, standardized protocols for data collection and validation can ensure accuracy and comparability, and should cover vehicle counts, vehicle sales (new and used), grid capacity, average daily use, localized freight user concentrations, and emissions profiles. Finally, long-term infrastructure planning will be critical to ensure the grid is ready to satisfy growing electrical loads and reduce charging uncertainties keeping investors on the sideline. Identifying factors creating market uncertainty must be an ongoing process that engages private-sector investors and allows national governments to address their concerns.
- 2. Ensure inclusion of ZETs in country strategy negotiations with development banks and global facilities.** National governments receiving DFI support have a large degree of influence in determining the areas of focus of that support. Ensuring freight is included will allow countries to set aside concessional funding to stimulate private investment and accelerate ZET adoption while preparing private companies to reap the economic benefits and job creation potential of the transition. Governments are encouraged to start by targeting the sectors that are most mature for electrification first, namely smaller trucks and vans operating in urban areas, and then moving toward heavier segments. At the same time, ZET needs should be mainstreamed across other relevant portfolios, including renewable energy generation, grid expansion, highway expansion, and economic sectors relying on trucks for everyday operations. This will maximize opportunities to accelerate adoption while establishing ZETs as the new normal for road freight and a key component of the energy transition.
- 3. Professionalize the freight sector.** Addressing informality in the freight sector is essential to ensure stable and sustainable operations. Governments need to collaborate with small owner-operators and the companies that hire their services to promote business formalization. Professionalization efforts should prioritize improving operational practices and financial training, as well as developing new procurement contracts that are supportive of ZETs by including longer service periods and bonuses for carbon-footprint reduction and brand positioning. Governments can incentivize professionalization by providing technical assistance to small business owners coupled with preferential credit loans to transition to ZETs.

Expanding access to financing for ZETs is essential to achieve sustainable, future-proof freight transportation that minimizes negative impacts on the environment and promotes human health and well-being. Governments, DFIs, and private-sector investors have a crucial role to play in fostering the necessary financial mechanisms and support systems. By implementing the proposed recommendations, decision-makers can accelerate the transition to zero-emission fleets, ushering in a cleaner, more resilient, and environmentally responsible future for the LAC region's transportation sector. The collective efforts of all stakeholders will be instrumental in driving the adoption of ZETs, ultimately contributing to the region's sustainable development goals and global climate commitments.

APPENDIX

STAKEHOLDER MAPPING

Various stakeholders at regional, national, and local levels are involved in the adoption of ZETs. The level of influence, intervention, and interest of these stakeholders in the introduction of ZETs shapes the enabling frameworks that allow for a greater or lesser degree of market maturity in each country. The main types of stakeholders identified in the researched countries are categorized as follows:

Figure 13. Main Types of Stakeholders

Government Agencies	Public entities responsible for regulating the freight transportation and energy sectors, such as national and subnational ministries of transport, energy, and environment.
Financial Institutions	Public or private entities that can facilitate access to financing for the adoption of ZETs, such as commercial and development banks.
Energy Service Providers	Public or private companies in charge of electricity distribution and charging infrastructure buildout.
Manufacturers	Companies dedicated to the manufacture and assembly of freight vehicles, also known as OEMs.
Academy, Non-Governmental Organizations	Public or private organizations focused on freight research, development, and advocacy.
Information Providers	Public organizations responsible for gathering and providing statistical data regarding status of transportation at national or subnational level.

The following table shows the participation of these actors in each of the countries studied.

Table 11. Participation of Caribbean Stakeholders/Countries

Stakeholders / Country	Caribbean Countries						
	Aruba	Barbados	Curaçao		Dominican Republic		Sint Maarten
Financing	Aruba Bank	Inter-American Development Bank World Bank Economic Commission for Latin America and the Caribbean CAF	Korpodeko	World Bank Economic Commission for Latin America and the Caribbean	Banco Popular Dominicano, HazteEco, Banco de Reservas, Renueva Verde	Inter-American Development Bank Economic Commission for Latin America and the Caribbean Agence Française de Développement (AFD) CAF	
Energy	TUI, Dynaf, Elmar	Barbados Light and Power Co	TUI, Dynaf, Aqualectra Evs		EverGo		DynafSXM
Manufacturers (ZE-MHDV)	Wuling Technology Center, JAC	BYD	Maxus, Renault		Fiat, Chevrolet, Hyundai, Kaiyun		Hyundai
Government Agencies		Transport Ministry	Central Bureau of Statistics Curaçao		Dirección General de Impuestos Internos (DGII)		
Information Providers	Central Bureau of Statistics		Nationaal archief				
Organized civil society Associations Academy					Asociación de transportadores de carga		
Distributor	Electric solution smart center, Motor world, Green Wheels Aruba	MegaPower, EV Isle Caribbean	Star Motors, HCR Motors Group, GreenMotion				Motor world

 Local


 Regional

Table 12. Participation of Latin American Stakeholders/Countries

Stakeholders / Country	Latin America Countries							
	Chile		Colombia		Mexico		Uruguay	
Financing	Banco Estado, Nuevo Capital, FR Group, Tanner	Inter-American Development Bank World Bank CAF Economic Commission for Latin America and the Caribbean	BBVA, Davivienda, Banco Occidente	Inter-American Development Bank World Bank CAF Economic Commission for Latin America and the Caribbean	BBVA, Banorte, Santander, CIBanco, Element, TIIP, NAFIN	Inter-American Development Bank World Bank CAF Economic Commission for Latin America and the Caribbean KFW	BBVA, Itaú, HSBC, Santander	BBVA, Banorte, Santander, CIBanco, Element, TIIP, NAFIN
Energy	Evsolutions, Enel, ThunderChile, Ecomobility		EnelX, ABB		Vemo, Voltway, Evergo, EnelX, SolarBeat		Wallbox, Duosida, Ecotap, Slak, EvBox, Tonhe	
Manufacturers (ZE-MHDV)	BYD, Chevrolet, Ford, Hyundai, JAC, JMC, MercedesBenz, Maxus, Peugeot, Renault		Mercedes, Ford, Toyota, BYD, JAC, Renault		BYD, Chevrolet, Ford, FAW, Hino, Hyundai, Isuzu, JAC, JMC, KingLong, Mercedes Benz, Maxus, Peugeot, Renault, Scania, Sunwin, Toyota, Volvo, VW, Yutong, Megaflux		BYD, FAW, Hozon, Hyundai, JAC, Keyton, Maxus, Mercedes, Volvo	
Companies (Freight Transport)	Cargotrader, Empresas Perrot, Transportes del Sol, Transportes Frontera, Transportes Manquehue		Coltanques, Transportes Vigía, Conalca, Edinsa y Transportes Montejo		Traxión, Grupo Alianza Trayecto, Grupo TUM, Autotransporte de Carga Tresguerras, Transportes Castores, Fletes México, Transportes Marva, Transportes Monroy Schiavon y Grupo Senda			
Government Agencies	Ministerio de Transportes y Telecomunicaciones		Ministerio de Transporte		Secretaría de Comunicaciones y Transporte (SICT)		Ministerio de Transporte y Obras Públicas	
Information Providers	Instituto Nacional de Estadística		Departamento Administrativo Nacional de Estadística (DANE)		Instituto Nacional de Estadística y Geografía (INEGI) Secretaría de Comunicaciones y Transporte (SICT)			
Organized civil society Associations Academy	Asociación Chilena de Industria del Transporte de Carga por Carretera		Cámara de Comercio de Bogotá		Instituto Mexicano del Transporte (IMT)		Asociación de Transporte de Carga	
Distributor	Derco, Grupo SKBergé, Grupo Minvest, Indumotora, Inchcape, SmartCargo				Asociación Mexicana de Distribuidores de Automotores, Asociaciones de Distribuidores por marca			

 Local

 Regional

REFERENCES

- [1] J. Barbero y P. Guerrero, «El transporte automotor de carga en América Latina: Soporte logístico de la producción y el comercio,» 2017. [En línea]. Available: <https://publications.iadb.org/es/el-transporte-automotor-de-carga-en-america-latina-soporte-logistico-de-la-produccion-y-el-comercio>.
- [2] «Tracking Clean Energy Progress 2023,» 2023. [En línea]. Available: <https://www.iea.org/reports/tracking-clean-energy-progress-2023>.
- [3] D. Welch, C. Façanha, R. Kroon, D. Bruil, F. Jousma y H. Weken, «Moving Zero-Emission Freight Toward Commercialization,» 2020. [En línea]. Available: <https://globaldrivetozero.org/site/wp-content/uploads/2020/12/Moving-Zero-Emission-Freight-Toward-Commercialization.pdf>.
- [4] «Financing the transition to electric trucks,» 2023. [En línea]. Available: https://globaldrivetozero.org/site/wp-content/uploads/2023/03/Financing_the_transition_to_electric_trucks_final.pdf.
- [5] «Global Memorandum of Understanding on Zero-Emission Medium- and Heavy-Duty Vehicles,» [En línea]. Available: <https://globaldrivetozero.org/mou-nations/>.
- [6] F. Ortiz y C. Obed, «Costos indirectos de transporte en el proceso de cruce fronterizo: El comercio entre Estados Unidos y México,» 2016. [En línea]. Available: <https://www.redalyc.org/articulo.oa?id=53043185007>.
- [7] «Realizar la caracterización energética del transporte automotor carretero de carga urbano e interurbano en el Territorio Nacional, con el propósito de fortalecer la construcción de las proyecciones de demanda, de los balances energéticos del país y de las,» 2020. [En línea]. Available: https://www1.upme.gov.co/DemandayEficiencia/Documents/Informe_final_caracterizacion_transporte.pdf.
- [8] «Caracterización del parque vehicular 2017 de Uruguay,» 2020. [En línea]. Available: <https://www.eficienciaenergetica.gub.uy/documents/20182/56464/Parque+vehicular+2017.pdf/28682cb1-92fc-4935-b39f-3a2e37efa1ea>.
- [9] «Información Registro Nacional de Despachos Carga (RNDC),» 2022. [En línea]. Available: <https://www.mintransporte.gov.co/publicaciones/9443/transporte-en-cifras/>.
- [10] «Parque de Vehículos,» 2020. [En línea]. Available: <https://regiones.ine.cl/biobio/estadisticas-regionales/economia/transporte-y-comunicaciones/parque-de-vehiculos>.
- [11] «Información de la Flota Vehicular Nacional,» 2022. [En línea]. Available: <https://www.sct.gob.mx/transporte-y-medicina-preventiva/autotransporte-federal/estadistica/2022/>.
- [12] «Parque Vehicular 2021,» 2021. [En línea]. Available: <https://dgii.gov.do/estadisticas/parqueVehicular/1Informes%20Parque%20Vehicular/ParqueVehicular2021.pdf>.
- [13] M. Terrill, I. Burfurd y L. Fox, «The Grattan truck plan. Practical policies for cleaner freight,» 2022. [En línea]. Available: <https://grattan.edu.au/wp-content/uploads/2022/08/Grattan-Truck-Plan-Report.pdf>.

- [14] J. A. Barbero, R. Fiadone y M. F. Millán, «El transporte automotor de cargas en América Latina,» 2020. [En línea]. Available: <https://publications.iadb.org/es/el-transporte-automotor-de-cargas-en-america-latina>.
- [15] «Decreto No. 332/995,» 1995. [En línea]. Available: https://www.aduanas.gub.uy/innovaportal/v/7483/3/innova.front/decreto-n%C2%B0-332_995.html.
- [16] «Ley 18483: Establece nuevo régimen legal para la industria automotriz,» 2019. [En línea]. Available: <https://www.bcn.cl/leychile/navegar?idNorma=29886>.
- [17] «Convenio de Complementación en el Sector Automotor,» [En línea]. Available: http://www.sice.oas.org/can/agreauto_s.asp.
- [18] «Import Rules, Regulations, Policies & Procedures To Import Japan Used Cars In Barbados,» [En línea]. Available: <https://blog.japanesecartrade.com/919-japan-used-car-import-duty-regulation-in-barbados/>.
- [19] «Importación de camiones usados a México alcanzó su nivel más alto de siete años,» 2021. [En línea]. Available: <https://www.eleconomista.com.mx/empresas/Importacion-de-camiones-usados-a-Mexico-alcanzo-su-nivel-mas-alto-en-siete-anos-20210928-0110.html>.
- [20] «Cuántas empresas hay en Colombia,» 2016. [En línea]. Available: <http://economiaaplicada.co/index.php/modal-centros-comerciales-modal/69-empresas/1000-ss0141?tmpl=component#:~:text=En%20Colombia%20existen%20alrededor%20de,millones%20de%20microempresas%5B1%5D>.
- [21] «Diagnóstico Sectorial APL Transporte de Carga por Carretera,» 2016. [En línea]. Available: <https://economiecirculaire.mma.gob.cl/wp-content/uploads/2023/04/2.-Diagnostico-sectorial-APL-Transporte-de-Carga-por-Carretera.-ChileTransporte-2016.pdf>.
- [22] P. Rosselli, F. Carriquiry, M. Perez y D. Varela, «El mercado de transporte carretero de cargas en Uruguay,» 2022. [En línea]. Available: <https://publications.iadb.org/es/el-mercado-de-transporte-carretero-de-cargas-en-uruguay>.
- [23] «Estadística Básica 2022,» 2022. [En línea]. Available: <https://www.sct.gob.mx/transporte-y-medicina-preventiva/autotransporte-federal/estadistica/2022/>.
- [24] «Latin America and the Caribbean Regional Overview,» 2022. [En línea]. Available: https://slocat.net/wp-content/uploads/2022/08/LAC-infographic_2022.08.03.pdf.
- [25] P. M. D. C. IDEAM, «Inventario Nacional y Departamental de Gases Efecto Invernadero - Colombia,» 2016. [En línea]. Available: <https://web.archive.org/web/20220901044942/http://documentacion.ideam.gov.co/openbiblio/bvirtual/023634/INGEI.pdf>.
- [26] «Categorías Vehiculares,» 2018. [En línea]. Available: <https://energia.gob.cl/electromovilidad/introduccion/categorias-vehiculares>.
- [27] M. d. Ambiente, «Uruguay. Inventario Nacional de Gases de Efecto Invernadero 1990-2019,» 2021. [En línea]. Available: https://unfccc.int/sites/default/files/resource/20220105%20URUGUAY%20NIR%201990_2019%20ESP.pdf.
- [28] «Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero (INEGyCEI),» 2021. [En línea]. Available: <https://datos.gob.mx/busca/dataset/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-eecto-invernadero-inegycei>.
- [29] S. Anenberg, J. Miller y R. Minjares, «New Study Quantifies the Global Health Impacts of Vehicle Exhaust,» 2019. [En línea]. Available: <https://theicct.org/new-study-quantifies-the-global-health-impacts-of-vehicle-exhaust/>.

- [30] «Central and South America,» 2019. [En línea]. Available: <https://www.iea.org/regions/central-south-america>.
- [31] «Aruba, Barbados and Colombia: International Renewable Energy Agency. Statistical Profiles,» 2023. [En línea]. Available: <https://www.irena.org/Data/Energy-Profiles>.
- [32] «Curaçao: National Renewal Energy Laboratory “Energy Snapshot”,» 2020. [En línea]. Available: <https://www.energy.gov/eere/articles/curacao-island-energy-snapshot-2020>.
- [33] «Boletín de Generación y Gestión de Energía,» 2022. [En línea]. Available: <https://mem.gob.do/wp-content/uploads/2023/01/Boletin-Informativo-Generacion-y-Gestion-Energia-Diciembre-2022.pdf>.
- [34] «Sint Maarten, Energy Snapshot,» 2020. [En línea]. Available: https://www.energy.gov/sites/default/files/2020/09/f79/ETI-Energy-Snapshot-St-Martin_FY20.pdf.
- [35] «Informe de actualización de antecedentes 2022. Planificación Energética de Largo Plazo,» 2022. [En línea]. Available: https://energia.gob.cl/sites/default/files/documentos/20220630_men_pelp_iaa2022.pdf.
- [36] «Balance Nacional de Energía 2020,» 2021. [En línea]. Available: https://www.gob.mx/cms/uploads/attachment/file/707654/BALANCE_NACIONAL_ENERGIA_0403.pdf.
- [37] «Energías Renovables en Uruguay,» 2022. [En línea]. Available: <https://www.uruguayxxi.gub.uy/es/centro-informacion/articulo/energias-renovables/>.
- [38] «Caribbean countries 2021: Worldwide Electricity Pricing: Energy Cost Per Km in 230 countries,» 2023. [En línea]. Available: <https://www.cable.co.uk/energy/worldwide-pricing/>.
- [39] «Aruba 2022: Aruba energy prices,» 2023. [En línea]. Available: <https://www.globalpetrolprices.com/Aruba/>.
- [40] «Barbados 2022: Barbados energy prices,» 2023. [En línea]. Available: <https://www.globalpetrolprices.com/Barbados/>.
- [41] «Curaçao 2022: Government of Curaçao,» 2022. [En línea]. Available: https://btpn.org/wp-content/uploads/2022/11/Prijzen-ElektraWater_Dec_2022_ENG.pdf.
- [42] «Dominican Republic 2022: Dominican Republic energy prices,» 2023. [En línea]. Available: <https://www.globalpetrolprices.com/Dominican-Republic/>.
- [43] «Movilidad Eléctrica,» [En línea]. Available: <https://cu.epm.com.co/clientesyusuarios/energia/hogar/movilidad-electrica>.
- [44] «Electromovilidad,» [En línea]. Available: <https://www.enerquinta.cl/electromovilidad>.
- [45] «Movilidad Eléctrica,» [En línea]. Available: <https://movilidad.ute.com.uy/>.
- [46] «Nuevo Contrato,» [En línea]. Available: <https://www.cfe.mx/negocio/nuevocontrato/pages/electrolinerasnegocio.aspx>.
- [47] ELMAR, «Electric Vehicles ChargeUp Stations,» [En línea]. Available: <https://www.elmar.aw/ev>.
- [48] «2023-2024 Regular Sessions,» 2023. [En línea]. Available: https://assembly.state.ny.us/leg/?default_fld=%E2%8B%9Avideo=&bn=A05052&term=2023&Floor%26nbspVotes=Y&Text=Y.
- [49] F. Tong, A. Jenn, D. Wolfson, C. Scown y M. Aufhammer, «Health and Climate Impacts from Long-Haul Truck Electrification,» 2021. [En línea]. Available: <https://pubs.acs.org/doi/10.1021/acs.est.1c01273>.

- [50] A. O'Connell, N. Pavlenko, G. Bieker y S. Searle, «A comparison of the life-cycle GreenHouse Gas Emissions of European Heavy-duty vehicles and fuels,» 2023. [En línea]. Available: <https://theicct.org/publication/lca-ghg-emissions-hdv-fuels-europe-feb23/>.
- [51] T. Möller y P. Schaufuss, «Road Mobility,» 2022. [En línea]. Available: <https://www.mckinsey.com/capabilities/sustainability/our-insights/spotting-green-business-opportunities-in-a-surging-net-zero-world/transition-to-net-zero/road-mobility>.
- [52] E. Hannon, M. Krishnan, J. Patel y S. Sahdev, «Mobility's net-zero transition: A look at opportunities and risks,» 2022. [En línea]. Available: <https://www.mckinsey.com/capabilities/sustainability/our-insights/spotting-green-business-opportunities-in-a-surging-net-zero-world/transition-to-net-zero/road-mobility>.
- [53] «Model e-x350,» 2023. [En línea]. Available: <https://jac.mx/producto/e-x350-23>.
- [54] «Model e-sunray,» 2023. [En línea]. Available: <https://jac.mx/producto/e-sunray-23>.
- [55] ICCT, «ZEV Cost: Total Cost of Ownership,» 2023. [En línea]. Available: <https://zevtc.org/tracking-progress/zev-cost-total-cost-of-ownership/>.
- [56] CALSTART, «CALSTART,» 2022. [En línea]. Available: <https://globaldrivetozero.org/zeti-data-explorer/>. [Último acceso: 2023].
- [57] K. Sumati, K. Tanzila, Y. Zifei y M. Josh, «Zero-Emission Vehicle Deployment: Latin America,» 2022. [En línea]. Available: <https://theicct.org/publication/hvs-zev-deploy-latam-apr22/>.
- [58] D. C. Rodríguez Vargas, M. C. Nocua Sanchez, M. A. Lancheros Barragan, L. K. Chaves Acosta, F. Mendoza Tellez, M. J. Puello Pertuz, N. Rodas Agudelo, C. Sanchez Ruiz y L. Galvis Peñuela, «Estrategia Nacional de Movilidad Eléctrica,» 2020. [En línea]. Available: <https://www1.upme.gov.co/DemandaEnergetica/ENME.pdf>.
- [59] «Acuerdo por el que se expide la Estrategia Nacional de Movilidad Eléctrica,» 2023. [En línea]. Available: <https://cofemersimir.gob.mx/portales/resumen/55366#>.
- [60] «Adquirimos en México 1,001 nuevos vehículos eléctricos de reparto,» 2022. [En línea]. Available: <https://www.grupobimbo.com/es/prensa/comunicados/medio-ambiente/adquirimos-en-mexico-1001-nuevos-vehiculos-electricos-de-reparto>.
- [61] G. Bimbo, «Grupo Bimbo duplicará este año su flotilla de vehículos eléctricos en México,» 2023. [En línea]. Available: <https://www.grupobimbo.com/es/prensa/comunicados/medio-ambiente/grupo-bimbo-duplicara-este-ano-su-flotilla-de-vehiculos>.
- [62] J. González, «Grupo Modelo Opens First Charging Station for Heavy Vehicles in Mexico City,» [En línea]. Available: <https://latamobility.com/en/grupo-modelo-opens-first-charging-station-for-heavy-vehicles-in-mexico-city/>.
- [63] M. F. Sosa, «Con central de carga, Grupo Modelo impulsa flotilla eléctrica,» *El Economista*, 2023.
- [64] «Electrologística,» [En línea]. Available: <https://electrologistica.cl/>.
- [65] «Guía de Electrologística. Primera Experiencia Electrologística (Región Metropolitana de Santiago Chile),» 2022. [En línea]. Available: https://www.girolimpio.cl/wp-content/uploads/2022/08/Guia_electrologi%CC%81stica-2022.pdf.
- [66] «Lineamientos de política para la modernización del transporte automotor de carga y declaratoria de importancia estratégica del programa de reposición y renovación del parque automotor de carga,» 2013. [En línea]. Available: https://www.mintransporte.gov.co/publicaciones/2648/observatorio_de_transporte_de_carga_por_carretera/descargar.php?id=3100.

- [67] «Micro y Pequeña Empresa Transportista,» [En línea]. Available: <https://www.nafin.com/portalfn/content/financiamiento/empresa-transportista.html>.
- [68] O. iLibrary, «Panorama of the multilateral development system,» [En línea]. Available: <https://www.oecd-ilibrary.org/sites/c1eb2caa-en/index.html?itemId=/content/component/c1eb2caa-en>.
- [69] «Project Cycle,» [En línea]. Available: <https://www.eib.org/en/projects/cycle/index.htm>.
- [70] «Políticas de Gestión,» 2019. [En línea]. Available: <https://www.caf.com/media/2826053/politicas-de-gestion-sep2019.pdf>.
- [71] «Project Cycle,» [En línea]. Available: <https://www.iadb.org/en/how-projects-are-made/how-projects-are-made>.
- [72] «Funding Proposal 189: E-Mobility Program for Sustainable Cities in Latin America and the Caribbean,» 2022. [En línea]. Available: <https://www.greenclimate.fund/sites/default/files/document/fp189-idb-multiple-countries.pdf>.
- [73] «FP195: E-Motion: E-Mobility and LowCarbon Transportation,» 2022. [En línea]. Available: <https://www.greenclimate.fund/project/fp195>.
- [74] «E-Buses Chile,» 2022. [En línea]. Available: <https://www.idbinvest.org/es/proyectos/e-buses-chile>.
- [75] «E-Buses Chile,» 2022. [En línea]. Available: <https://disclosures.ifc.org/project-detail/SII/44610/e-buses-chile>.
- [76] «Accelerating the Adoption of Electric Mobility in Chile,» 2021. [En línea]. Available: <https://www.thegef.org/projects-operations/projects/10277>.
- [77] «Supporting the Chilean Low Emission Transport Strategy CLETS,» 2019. [En línea]. Available: <https://www.thegef.org/projects-operations/projects/9742>.
- [78] «Moving Chile:Upscaling electric mobility in Chile,» 2019. [En línea]. Available: <https://www.giz.de/en/worldwide/80014.html>.
- [79] «BID Invest y Enel X unen fuerzas para impulsar la electromovilidad en Colombia,» 2023. [En línea]. Available: <https://www.idbinvest.org/es/medios-y-prensa/bid-invest-y-enel-x-unen-fuerzas-para-impulsar-la-electromovilidad-en-colombia>.
- [80] «Guagua Usme Electric Bus Project,» 2022. [En línea]. Available: <https://www.idbinvest.org/es/proyectos/guagua-usme-electric-bus-project>.
- [81] «IDB Invest, ILX and Bladex Support Electromobility and Vehicle Financing in Colombia with Finanzauto,» 2023. [En línea]. Available: <https://www.idbinvest.org/en/news-media/idb-invest-ilx-and-bladex-support-electromobility-and-vehicle-financing-colombia>.
- [82] «BBVA Leasing Mexico S.A.,» 2019. [En línea]. Available: <https://disclosures.ifc.org/project-detail/SII/38504/bbva-leasing-mexico-s-a>.
- [83] «Promoting efficient and intelligent public transport in Mexico,» 2023. [En línea]. Available: <https://www.giz.de/en/worldwide/120898.html>.
- [84] «Quarterly Status Report,» 2023. [En línea]. Available: https://www.nadb.org/uploads/files/nadbank_quarterly_status_report.pdf.
- [85] «Summary of project implementation activities. Active Projects,» 2023. [En línea]. Available: https://www.nadb.org/uploads/files/active_project_report.pdf.
- [86] «Nafin impulsa proyectos de financiamiento relacionados al transporte sostenible,» [En línea]. Available: <https://www.nafin.com/portalfn/content/sobre-nafin/sala-de-prensa/boletin-27-2022.html>.

- [87] «FZ-Programm zur Umsetzung der nationalen Klimaschutzziele im mexikanischen Transportsektor,» [En línea]. Available: <https://www.kfw-entwicklungsbank.de/ipfz/Projektdatenbank/FZ-Programm-zur-Umsetzung-der-nationalen-Klimaschutzziele-im-mexikanischen-Transportsektor-44726.htm>.
- [88] «Firman Nafin y SEMOVI convenio con KfW para impulsar electromovilidad en taxis de la Ciudad de México,» 2022. [En línea]. Available: <https://jefaturadegobierno.cdmx.gob.mx/comunicacion/nota/firman-nafin-y-semovi-convenio-con-kfw-para-impulsar-electromovilidad-en-taxis-de-la-ciudad-de-mexico>.
- [89] «DR-T1229: ECO-DELIVERY: Electro Mobility, Environment and Intelligence,» 2021, [En línea]. Available: <https://www.iadb.org/en/project/DR-T1229>.
- [90] «Hacia un sistema de movilidad urbana sostenible y eficiente en Uruguay,» 2017. [En línea]. Available: https://moves.gub.uy/wp-content/uploads/2019/11/PRODOC_MOVESUY_esp.pdf.
- [91] «BID y Fondo Verde para el Clima promueven la e-movilidad en América Latina y el Caribe,» 2022. [En línea]. Available: <https://www.iadb.org/es/noticias/bid-y-fondo-verde-para-el-clima-promueven-la-e-movilidad-en-america-latina-y-el-caribe>.
- [92] «USD 231 millones para escalar la movilidad eléctrica en Panamá, Paraguay y Uruguay,» 2022. [En línea]. Available: <https://www.caf.com/es/actualidad/noticias/2022/10/usd-231-millones-para-escalar-la-movilidad-electrica-en-panama-paraguay-y-uruguay/>.
- [93] «Electric Vehicles: An Economic and Environmental Win for Developing Countries,» 2022. [En línea]. Available: <https://www.worldbank.org/en/news/feature/2022/11/17/electric-vehicles-an-economic-and-environmental-win-for-developing-countries>.
- [94] «Project Details,» [En línea]. Available: <https://www.iadb.org/en/projects-search?country=§or=TR&status=&query=>.
- [95] «The Global Facility to Decarbonize Transport GFDT. Supporting Countris in their Decarbonization Initiatives,» [En línea]. Available: <https://thedocs.worldbank.org/en/doc/e14c76f49f8907a58fbfe039fc51d8d3-0190072021/original/GFDT-Concept-Note.pdf>.
- [96] G. F. Institute, «Road to Zero. Unlocking public and private capital to decarbonise road transport,» 2021. [En línea]. Available: <https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2021/12/GFI-CDRT-REPORT.pdf>.
- [97] «Financing the transition. Unlocking capital to electricity truck and bus fleets,» 2020. [En línea]. Available: https://www.edf.org/sites/default/files/documents/EDF_Financing_The_Transition.pdf.
- [98] «Inventario Nacional de Emisiones y Absorciones de Gases de Efecto Invernadero – INGEI,» [En línea]. Available: <https://www.minambiente.gov.co/cambio-climatico-y-gestion-del-riesgo/inventario-nacional-de-emisiones-y-absorciones-de-gases-de-efecto-invernadero-ingei/>.
- [99] «Tercer Informe Bienal de Actualización de Chile sobre Cambio Climático 2018,» 2018. [En línea]. Available: https://unfccc.int/sites/default/files/resource/2018_NIR_CL.pdf.
- [100] «Inventarios Nacionales de Gases de Efecto Invernadero (INGEI),» 2020. [En línea]. Available: <https://www.gub.uy/ministerio-ambiente/politicas-y-gestion/inventarios-nacionales-gases-efecto-invernadero-ingei>.
- [101] F. Ramírez Hernández, «Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero,» 2018. [En línea]. Available: https://www.gob.mx/cms/uploads/attachment/file/312045/INEGYCEI6CN_26_marzo_2018.pdf.

