Electric vehicle development and strategies among leading automakers: Comparing Brazil with other major markets

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INTRODUCTION

Brazil's vehicle market ranked 6th in global sales in 2023, with more than 2.3 million units sold.[1] Its light-duty vehicle (LDV) market is dominated by legacy automakers, led by Stellantis, Volkswagen (VW), and General Motors (GM).[2] Legacy companies have committed to ambitious electric vehicle (EV)[3] sales targets in other major vehicle markets like the United States, the European Union (EU), the United Kingdom, and China, spurred by tightening regulations and incentives in these markets.[4] In Brazil, however, many of these automakers are pursuing a decarbonization strategy focused on the development of gasoline-ethanol flex-fuel hybrid vehicles, whose average well-to-wheel emissions are substantially higher than those of battery electric vehicles (BEVs).[5]

This briefing examines the EV development and sales strategies that automakers are pursuing in Brazil compared with other major global vehicle markets. It specifically explores how automakers prioritize EV deployment in other major markets while continuing to focus mostly on internal combustion engine vehicles (ICEVs), mild hybrid electric vehicles (MHEVs), and conventional hybrid electric vehicles (HEVs) in Brazil.

1 International Organization of Motor Vehicle Manufacturers, *Sales Statistics* [Dataset], accessed November 19th, 2024, https://www.oica.net/category/sales-statistics/.

2 Federação Nacional da Distribuição de Veículos Automotores, *Emplacamentos: Resumo Mensal Dezembro de 2023* [Registrations: December 2023 Monthly Summary] (December 2023), https://www.fenabrave.org.br/portalv2/Conteudo/Emplacamentos.

3 EVs include both battery electric and plug-in hybrid electric vehicles.

4 Chang Shen et al., *Global Automaker Rating 2023* (International Council on Clean Transportation, 2024), https://theicct.org/global-automaker-rating-2023/.

5 Guido Haytzmann and André Cieplinski, *Tecnologias de Propulsão e Emissões de CO_2e: Comparação de Veículos Elétricos e Híbridos no Brasil* [Propulsion Technologies and CO_2e emissions: Comparison of Electric and Hybrid Vehicles in Brazil] (International Council on Clean Transportation, 2025), https://theicct.org/publication/pt-tecnologias-de-propulsao-e-emissoes-de-co2e-mar25/; Zamir Mera et al., *Comparison of the Life-Cycle Greenhouse Gas Emissions of Combustion Engine and Electric Passenger Cars in Brazil* (International Council on Clean Transportation, 2023), https://theicct.org/publication/comparison-of-life-cycle-ghg-emissions-of-combustion-engines-and-electric-pv-brazil-oct23/.

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This analysis helps contextualize automakers' approaches to the global zero-emission vehicle (ZEV) transition and the effectiveness of Brazil's current policy framework in encouraging the development of the country's ZEV market.

The next section examines the policy context in Brazil, highlighting the promotion of ethanol as an alternative to gasoline for LDVs and recent efforts to develop the ZEV market. We then compare Brazil's EV market with the six markets analyzed in the ICCT's *Global Automaker Rating 2023*: China, Europe,[6] the United States, Japan, India, and the Republic of Korea.[7] Next, we assess differences between automakers' stated ZEV commitments in Brazil and other major markets and compare the well-to-wheel life-cycle greenhouse gas (GHG) emissions of BEVs, HEVs, and plug-in hybrid electric vehicles (PHEVs) in Brazil with those of BEVs in those other markets. We close with policy considerations based on our results.

BACKGROUND AND POLICY CONTEXT

Following the 1973 oil crisis, Brazil instituted the *Proálcool* program, fostering increased sugarcane ethanol production and the development of ethanol-fueled passenger cars.[8] Despite initial success, ethanol-exclusive cars lost ground in the Brazilian market during the 1980s–1990s.[9] However, during the 2000s, manufacturers began commercializing ethanol-gasoline flex-fuel vehicles, which now comprise about 80% of Brazil's circulating LDV fleet.[10] These cars can be fueled with 100% ethanol (E100) or the national blend of gasoline (E27), which contains 27% anhydrous ethanol. Flex-fuel vehicles can have lower GHG emissions than fully gas-powered counterparts due to the relatively low emissions of Brazil's sugarcane ethanol; however, their real-world GHG mitigation potential depends on consumers' choice of fuel—and, by extension, fuel prices. As of 2023, E100 represented 36,7% (by volume) of the fuel used in flex-fuel vehicles, with E27 accounting for 63,3%.[11] Ethanol thus supplied about half of the total fuel consumed by spark-ignition engine vehicles in 2023, or one-third of their energy consumption.

In 2023, the government announced the Green Mobility and Innovation (MOVER) Program, which regulates new vehicle emissions and provides incentives for producing low-emission vehicles. Enacted in 2024, MOVER includes subsidies for producing flex-fuel hybrids until 2026.[12] MOVER's launch set off an unprecedented round of investment in the Brazilian automotive industry: 14 automakers announced over $20 billion (R$ 130 billion) in investments in the country by 2030.[13] However, despite MOVER's objective to reduce new vehicle emissions and help achieve Brazil's net-zero commitment by 2050—which will require a rapid acceleration of ZEV adoption—most

6 European data include vehicle sales in the EU, European Free Trade Association Member States, and the UK.

7 Shen et al., *Global Automaker Rating 2023*. This analysis was conducted prior to the publication of the *Global Automaker Rating 2024/2025*; this new edition of the report follows the same evaluation framework and evaluates the same 21 automakers as the 2023 edition.

8 Manfred Nitsch, "The Proálcool Biofuels Program in the Context of the Brazilian Energy Strategy," *Brazilian Journal of Political Economy 11*, no. 2 (1991): 274–299, https://doi.org/10.1590/0101-31571991-0712.

9 Evidence and Lessons from Latin America, *The Story of Brazil's Ethanol Programme* (2013), https://assets.publishing.service.gov.uk/media/57a08a08ed915d622c00050b/130806_ENV_BraEthPro_GUIDE.pdf.

10 Boston Consulting Group, *Avançando nos Caminhos da Descarbonização Automotiva no Brasil* [Advancing on the Paths of Automotive Decarbonization in Brazil] (2024), https://www.bcg.com/publications/2024/brasil-avancando-nos-caminhos-da-descarbonizacao-automotiva-no-brasil.

11 Energy Research Office (EPE, from the Portuguese *Empresa de Pesquisa Energética*), Nota Técnica: *Descarbonização do Setor de Transporte Rodoviário, Intensidade de Carbono das Fontes de Energia* [Technical Note: Decarbonization of the Road Transport Sector, Carbon Intensity of Energy Sources] (2025), https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-708/topico-770/NT-EPE-DPG-SDB-2025-03_Intensidade_de_Carbono_Transporte_Rodovi%C3%A1rio.pdf. .

12 Law Nº 14.902, of June 27, 2024, https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2024/lei/l14902.htm.

13 EPE, *Eletromobilidade: Transporte Rodoviário* [Electromobility: Road Transport] (August 2024), https://theicct.org/wp-content/uploads/2023/10/Brazil-LDV-LCA-report-A4-v7.pdf.

of these announcements entailed new investments in flex-fuel ICEV production.[14] Moreover, even automakers with firm commitments to introduce ZEVs elsewhere appear to be leaning toward hybrid-first strategies in Brazil. All this suggests that clearer policy guidance or ZEV-enforcing regulations may be needed to incentivize ZEV investments.

Unlike the governments of some other leading markets, the government of Brazil has not offered direct EV purchase subsidies, though it has sought to encourage EV adoption through tax breaks and other incentives. Most recently, a 2025 decree adjusted Industrialized Product Tax rates on vehicles based on their powertrain, reducing taxes on BEVs and ethanol-gasoline flex-fuel PHEVs by equal amounts, providing smaller rate reductions for other flex-fuel hybrid technologies, and increasing rates on gasoline- and diesel-exclusive models, including gasoline exclusive HEVs and PHEVs.[15]

Between 2022 and 2024, Brazil's BEV market share rose from 0.3% to 2.5%, while the PHEV share grew from 0.4% to 2.5%.[16] The arrival of new automakers has resulted in increased sales of EVs due to wider class coverage and the availability of new models, including three models priced below the average passenger car in Brazil. While EV sales share reached 6.5% in the first half of 2025, Brazil still lags other major markets in EV adoption. In the first half of 2024, EVs accounted for 37% of new LDV sales in China, 18% in the European Union, and 9% in the United States. About 17% of all LDVs sold worldwide in the first half of 2024 were EVs, totaling more than 7 million vehicles.[17]

EV MARKET COMPARISON: BRAZIL AND OTHER MAJOR MARKETS, 2023

This section compares automakers' progress toward electrifying their vehicle offerings in Brazil and in the six vehicle markets assessed in the ICCT's *Global Automaker Rating 2023*: China, Europe, the United States, Japan, India, and the Republic of Korea. First, it shows that for the top 10 automakers in Brazil in 2023, EV sales shares (i.e., the share of EVs out of total LDV sales) were lower in Brazil than on average across the six other markets. Second, it shows that of the 17 automakers considered in the *Global Automaker Rating* that sold vehicles in Brazil in 2023,[18] all had a lower BEV class

14 "Mover Estimulou Investimentos de R$ 67 Bilhões" [Mover Stimulated Investments of $R 67 Billion], *Autodata*, April 4, 2024, https://www.autodata.com.br/noticias/2024/04/04/mover-estimulou-investimentos-de-r-67-bilhoes/70245/; "Toyota Confirma Investimento de R$ 11 Bilhões em Sorocaba e Porto Feliz" [Toyota Confirms Investment of R$ 11 Billion in Sorocaba and Porto Feliz], *Autodata*, March 5, 2024, https://www.autodata.com.br/noticias/2024/03/05/toyota-confirma-investimento-de-r-11-bilhoes-em-sorocaba-e-porto-feliz/68715/; "Stellantis Investirá R$ 30 Bilhões nos Próximos 5 Anos no Brasil" [Stellantis Will Invest $R 30 Billion in the Next 5 Years in Brazil], *Autodata*, March 6, 2024, https://www.autodata.com.br/noticias/2024/03/06/stellantis-investira-r-30-bilhoes-nos-proximos-5-anos-no-brasil/68756/; André Catto, "Híbridos Flex: Por Que a Tecnologia Está no Centro dos R$ 117 Bilhões de Investimentos das Montadoras" [Flex Hybrids: Why the Technology is at the Center of Automakers' R$ 117 Billion Investments], *Globo.com*, March 9, 2024, https://g1.globo.com/carros/noticia/2024/03/09/hibridos-flex-por-que-a-tecnologia-esta-no-centro-dos-r-117-bilhoes-de-investimentos-das-montadoras.ghtml; GM, "GM Investe R$ 5,5 Bilhões em São Paulo e Vai Produzir Veículos Híbridos Flex" [GM Invests R$ 5.5 Billion in São Paulo and Will Produce Flex Hybrid Vehicles], press release, September 4, 2024, https://news.chevrolet.com.br/newsroom.detail.html/Pages/news/br/pt/2024/aug/0904-investe.html; "Toyota e Renault Colocam as Suas Fichas nos Híbridos Flex" [Toyota and Renault Put Their Bets on Flex Hybrids], *Autodata*, October 21, 2024, https://www.autodata.com.br/noticias/2024/10/21/toyota-e-renault-colocam-as-suas-fichas-nos-hibridos-flex/79453/.

15 Decree Nº 12.549, of July 10, 2025, https://pesquisa.in.gov.br/imprensa/jsp/visualiza/index.jsp?data=11/07/2025&jornal=515&pagina=1&totalArquivos=291.

16 André Cieplinski, *Evolução Recente do Mercado Brasileiro de Veículos Leves: A Chegada de Elétricos e Híbridos (2021–2024)* [Recent Evolution of the Brazilian Light Vehicle Market: The Arrival of Electric and Hybrid Vehicles (2021–2024)] (International Council on Clean Transportation, 2024), https://theicct.org/publication/evolucao-recente-do-mercado-brasileiro-de-veiculos-leves-a-chegada-de-eletricos-e-hibridos-2021-2024-dec24/.

17 Ilma Fadhil and Chang Shen, Global Electric Vehicle Market Monitor for Light-Duty Vehicles in Key Markets, 2024 H1 (International Council on Clean Transportation, 2024), https://theicct.org/publication/global-ev-market-monitor-ldv-2024-h1-dec24/.

18 *The Global Automaker Rating 2023* assessed the top 21 automakers by global LDV sales, of which 17 recorded sales in Brazil in 2023.

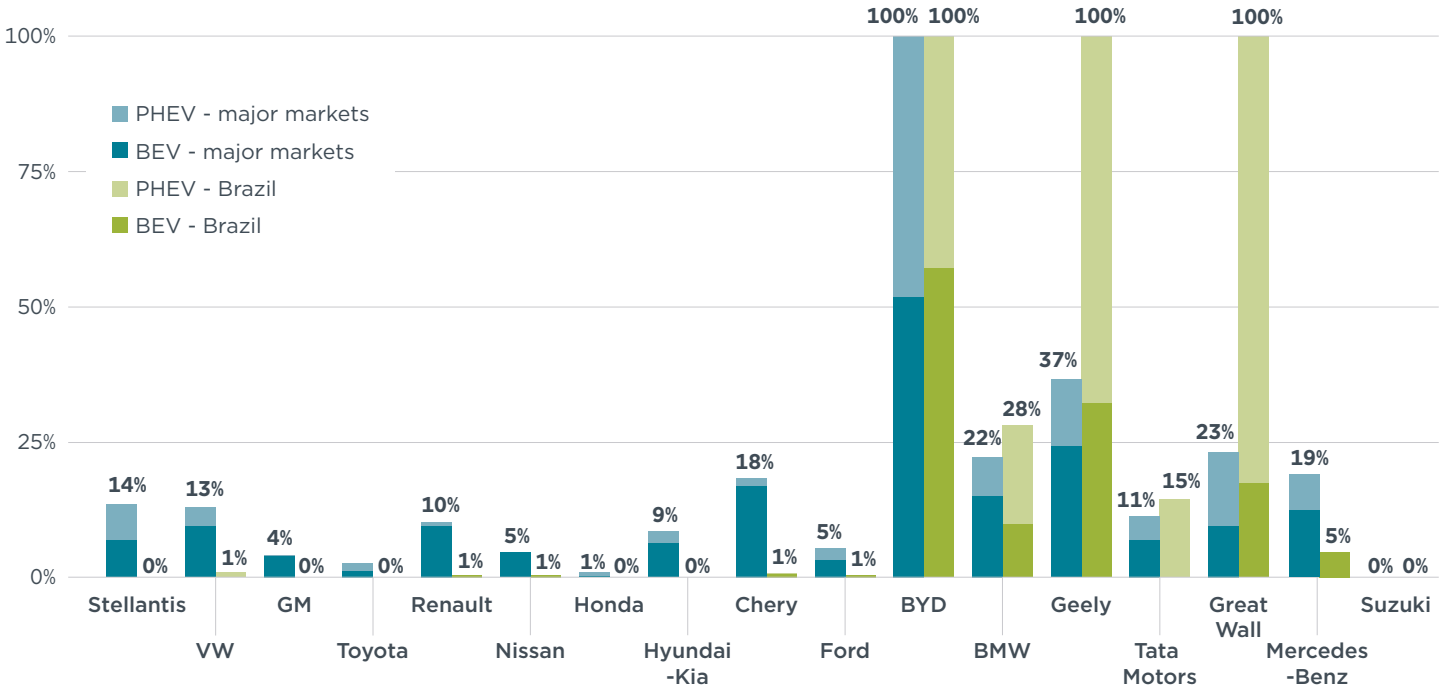
coverage in Brazil than in the other major markets,[19] and only five offered EVs in as many classes as they offered ICEVs. The section closes with a comparison of EV driving range in Brazil versus other major markets.

ELECTRIC VEHICLE MARKET SHARE

Figure 1 compares the market shares of BEVs and PHEVs for the 17 automakers in 2023 in Brazil (green) and on average in the other six major markets (blue). Darker shaded bars represent BEVs, while lighter shaded bars represent PHEVs. The percentages at the top of each bar indicate the combined EV (BEV and PHEV) sales share of that manufacturer in Brazil or on average across the other major markets. Automakers are ordered from highest (left) to lowest (right) sales in Brazil in 2023.

Figure 1

EV market share by automaker, Brazil vs. other major markets' average, 2023



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EV sales in Brazil in 2023 were highly concentrated among three China-based automakers—BYD, Geely, and Great Wall. All three exclusively offered EVs in Brazil, albeit with differing proportions of BEVs and PHEVs. By BEV sales share, BYD led with a 57% share of BEVs and 43% of PHEVs, followed by Geely (32% BEVs; 68% PHEVs) and Great Wall (17% BEVs; 83% PHEVs). In contrast, the top six automakers in Brazil by absolute LDV sales (Stellantis, VW, GM, Toyota, Renault, and Nissan) had little to no presence in the country's BEV and PHEV markets. Among European brands, only BMW achieved a BEV market share above 10%, further indicating limited engagement from legacy automakers in Brazil's EV market.

Average EV sales shares in the six major markets appear more balanced across manufacturers, with a greater variety of automakers recording shares in or near the double digits. BYD averaged a 52% BEV share and a 48% PHEV share across the other major markets, reflecting its consistent EV strategy across regions. Geely, which

19 This excludes Suzuki, which did not offer any BEVs in Brazil or elsewhere.

exclusively sells EVs in Brazil through its subsidiaries Volvo Cars and Zeekr, registered a 24% BEV share and a 12% PHEV share in other major markets.

European automakers showed a stronger focus on EVs in other markets, with VW, Renault, BMW, and Mercedes-Benz each achieving average BEV shares above 10%. Stellantis followed closely with a 7% BEV share. Japanese and Korean automakers lagged their European counterparts in average EV sales share across the other major markets but still sold fewer EVs in Brazil. On the other hand, in addition to Geely and Great Wall, which only sold EVs in Brazil, BMW and Tata Motors (through its Jaguar and Land Rover brands) had higher EV sales shares in Brazil than in other major markets.

CLASS COVERAGE

Class coverage measures the range of vehicle classes that each manufacturer offers. Broader class coverage indicates greater investment in diverse vehicle technologies, which positions manufacturers to reach a larger customer base as the EV market expands, enhancing consumer choice.

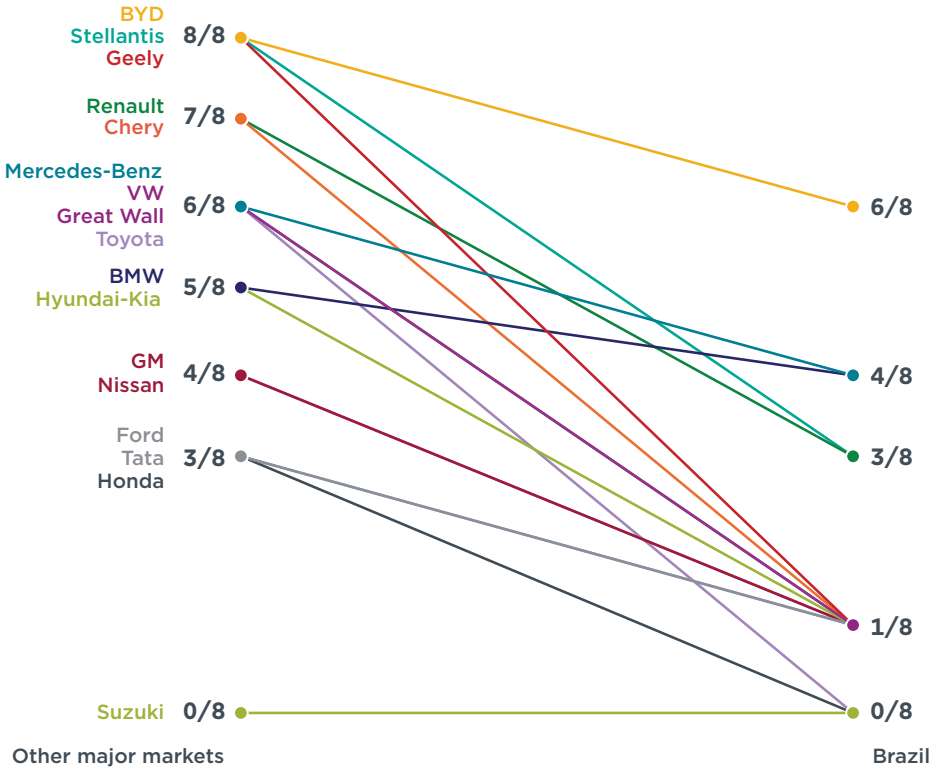
In this study, LDVs are divided into eight classes based on the ICCT's *Global Automaker Rating.* Passenger cars (PCs) are subdivided into five classes: mini/subcompact (e.g., MINI Cooper, Fiat 500), compact (e.g., Nissan Leaf, GWM Ora 03), midsize (e.g., Tesla Model 3, BYD Seal), large (e.g., Mercedes-Benz EQE Sedan), and SUV (e.g., VW ID.4). Light commercial vehicles (LCVs) are subdivided into three classes: small (e.g., Fiat E-Scudo), medium (e.g., Renault Kangoo E-Tech) and large (e.g., Ford E-Transit). Details on these classifications are provided in Appendix B.

For each automaker, class coverage in Brazil was calculated as the share of vehicle classes in which the automaker offers at least one BEV model in the Brazilian market. Similarly, class coverage in other major markets was calculated as the share of vehicle classes in which the automaker offers at least one model across any of the major markets defined the ICCT's *Global Automaker Rating*. This comparison helps assess the diversity of BEV offerings in Brazil relative to what each manufacturer has offered in other markets.

Figure 2 compares top automakers' BEV class coverage in Brazil versus other major markets. For all automakers except Suzuki, which did not offer any BEVs in Brazil or in other major markets, BEV class coverage was lower in Brazil. BYD had the widest coverage in Brazil, covering six of eight LDV classes, compared with its full LDV class coverage across other major markets. Some European manufacturers also performed relatively well, with Mercedes-Benz and BMW each covering four LDV classes in Brazil, against six (Mercedes-Benz) and five (BMW) in other major markets. Other automakers had wider coverage gaps. For example, Stellantis had full coverage among major markets but covered just three classes in Brazil. VW scored lowest among European manufacturers, covering only one LDV class in Brazil, compared with six classes in other major markets.

Figure 2

BEV class coverage in other major markets and Brazil, 2023



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China-based automakers except for BYD stood out for coverage gaps between Brazil and other major markets. Geely, Great Wall, and Chery each covered one class in Brazil but at least six classes in other major markets. Geely had the largest gap among automakers, offering BEVs in one class in Brazil but all eight classes in other markets. Toyota followed, offering no BEVs in Brazil but six classes in other major markets.

Table 1 illustrates the class coverage in Brazil by powertrain among the 17 automakers. The presence of a colored circle indicates the availability of at least one model of that powertrain, with BEVs in purple, PHEVs in yellow, and ICEVs in gray. The bottom row shows the total number of manufacturers offering vehicles in each class by powertrain type, and the right-most column shows the number of classes each manufacturer covers across different powertrain types.

Table 1

Class coverage in Brazil by automaker and powertrain, 2023

Automaker	Class coverage								
	PC - Subcompact	PC - Compact	PC - Midsize	PC – Large	PC - SUV/ MPV	LCV – Small	LCV - Medium	LCV – Large	Total (out of 8 classes)
Stellantis	● ●	● ●	●		● ●	●	● ●	●	7 3 1
VW	●	●	● ●	● ● ●	● ●			●	6 1 3
GM		● ●	●	●	●			●	5 1 0
Toyota		●	●	●	● ●			●	5 0 1
Renault	● ●	● ●	●		●	●		●	5 3 0
Nissan		● ●	●		●			●	4 1 0
Honda		●	●		●			●	3 0 0
Hyundai-Kia	●	● ●			●		●		5 1 0
Chery	●		●		● ●			●	2 1 1
Ford		●	● ●						3 1 0
BYD	●	●	●	●	● ●		●	●	0 6 1
BMW	● ●	● ● ●	● ● ●	● ●	● ●				4 4 4
Geely					● ●				0 1 1
Tata Motors		●		●	● ● ●				3 1 1
Great Wall		●			● ●				1 1 1
Mercedes-Benz		● ●	● ●	● ●	● ●				5 4 0
Suzuki	●								1 0 0
Total (out of 17 Automakers)	6 5 0	12 9 1	11 4 2	5 4 2	13 4 9	2 2 0	2 2 0	9 0 0	

● ICEV ● BEV ● PHEV

Note: HEVs and MHEVs are included under ICEVs, represented by the gray circles.

Most automakers in Brazil continue to rely on ICEVs. Seven of the 17 automakers covered at least five of eight classes among ICEVs. European automakers led in ICEV class coverage, with Stellantis covering seven classes, VW six, and Renault and Mercedes-Benz five each. GM, Toyota, and Hyundai-Kia also had extensive ICEV coverage, each covering five classes.

Compared with BEVs, PHEV class coverage is even more limited in Brazil, with only a few automakers (primarily European) represented in this category. BMW led with PHEV coverage in four classes, followed by VW with three. More than half of the automakers assessed in this study did not offer any PHEV models in Brazil.

Table 1 shows a higher class coverage of BEVs in smaller segments like subcompact and compact passenger cars. PHEV availability, in contrast, is concentrated among SUVs. For LCVs, the class coverage of BEVs and PHEVs in Brazil is still limited. Overall, the analysis of class coverage suggests that ICEVs remain the primary focus in Brazil for most global automakers, with limited diversification into BEV or PHEV offerings.

DRIVING RANGE

The driving ranges of EVs in Brazil and other major markets were calculated based on Worldwide harmonized Light vehicles Test Procedure (WLTP) type-approval values. For each automaker, the fleet-level average driving range was determined using the sales-weighted average of each model's range.

There were considerable differences in EV driving range between Brazil and other major markets, but the extent and direction of such gaps varied among the 17 automakers, with no clear pattern. As shown in Figure 3, out of the 13 automakers that sold BEVs in Brazil, eight had higher fleet-average ranges in Brazil.[20] Three automakers sold substantially higher-range BEVs in Brazil than in other major markets: Tata Motors led with 471 km in Brazil versus 334 km in other major markets (+41%), followed by Chery with 282 km in Brazil versus 209 km (+35%) and Geely with 466 km in Brazil versus 367 km (+27%). In contrast, three automakers had lower fleet-average ranges in Brazil than in other major markets: BMW with 441 km versus 495 km (-11%), VW with 424 km versus 483 km (-11%), and Hyundai-Kia with 360 km versus 432 km (-17%).

Figure 3

Driving range by automaker: Brazil vs. other major market average, 2023

Note: The driving range in the figure represents the fleet-average range for each automaker, calculated using the sales-weighted WLTP type approval driving range of each model.

20 Values described in this section and presented in Figure 3 reflect type approval driving range. Brazil's labelling program reduces type approval ranges by 30% to reflect real-world conditions. To make Brazil data comparable to major markets, we divided type approval values for Brazilian vehicles by 0.7.

Among the seven automakers that sold PHEVs in Brazil, three offered notably higher average ranges compared with other major markets. Great Wall led with 166 km in Brazil versus 112 km in other major markets (+49%), followed by Tata Motors with 69 km versus 52 km (+33%) and BMW with 75 km versus 68 km (+11%). In contrast, four automakers had lower average PHEV ranges in Brazil; these were led by BYD, whose 40 km PHEV range in Brazil was 49% lower than its 79 km range in major markets, followed by Stellantis (43 km vs. 54 km, -21%), Geely (76 km vs. 87 km, -12%), and VW (51 km vs. 53 km, -4%).

Multiple factors could contribute to the variation in driving ranges between Brazil and other major markets, including consumer preferences and competitive dynamics among automakers. However, the absence of a clear pattern could also reflect differences in automaker strategies and priorities among markets. For example, some automakers have achieved higher ranges in Brazil from exclusively offering premium brands there. During the study period, Geely sold only Volvo Cars models in Brazil, while Tata Motors sold solely Jaguar and Land Rover vehicles.

DIVERGENT ELECTRIFICATION STRATEGIES: COMPARING AUTOMAKERS' COMMITMENTS IN BRAZIL AND OTHER MAJOR MARKETS

Many global automakers have announced electrification commitments as part of decarbonization efforts, with some setting net-zero emission targets. Automakers' commitments are influenced by regulations, as more governments, especially in major vehicle markets, aim to move away from ICEVs and electrify vehicle fleets to decarbonize road transportation sectors consistent with Paris Agreement goals. For this reason, some automakers may have ambitious targets in certain markets but weaker or no targets in others, especially in markets with less stringent emission regulations in place.

Table 2 summarizes the announced EV sales targets of the 17 automakers considered in this study. Targets reflect announcements through 2024 and are organized by scope: specific to Brazil, specific to one (or more) of the other major markets in the ICCT's *Global Automaker Rating*, or applicable globally. The table presents each automaker's 2023 LDV sales in Brazil and, if applicable, the sales share and target year associated with each commitment.

Table 2

Automakers' EV targets in Brazil, global targets, and targets in other major markets

Automaker	2023 sales in Brazil	Brazil		Global		Other major markets				
		Target	Year	Target	Year	United States	Europe	China	Others	Year
Stellantis	681,932					50%	100%			2030
VW	358,807					55%	80%	50%		2030
GM	328,205					100%	100%	100%	100%	2035
Toyota	193,171			32%	2030					
Hyundai	191,141	30%	2030	36%^	2030		100%			2035
Renault	125,789						100%			2035
Nissan	72,559			40%	2030					
Honda	72,055			100%	2040			100%		2035
Chery	31,481			40%*	2025					
Ford	28,039					100%	100%	100%	100%	2035
BYD	17,947			100%*	2023					
BMW	16,704			50%	2030					
Great Wall	11,479			80%*	2025					
Mercedes-Benz	8,715			50%*	2030	100%	100%	100%	100%	2035
Geely (Volvo Cars)	8,190	90%*	2030	90%*	2030					
Tata Motor (Jaguar Land Rover)	5,385			100%^	2025	100%^	100%^	100%^	100%^	2035
Suzuki	986						80%		15%-20%^	2030

Notes:
Under major markets, "Others" include India, Japan, and the Republic of Korea.
* signifies that targets include PHEVs.
^ indicates brand- or market-specific targets. Hyundai, a Hyundai-Kia subsidiary, has set a target of 80% ZEV sales by 2040. Subsidiaries under Tata Motors have separate ZEV targets: Jaguar has a global target of 100% ZEV by 2025, and Land Rover has a global target of 100% ZEVs by 2035. In addition, Suzuki has three region-specific ZEV targets: 80% by 2030 in the European Union, 20% by 2030 in Japan, and 15% by 2030 in India.

Each of the 17 automakers considered in this study has set EV sales share or sales targets either globally or in one or more of the other major markets. In addition to BYD, which already only produces EVs, eight automakers have established 100% ZEV targets for at least one brand globally or in leading markets by 2040. This includes several legacy automakers. Jaguar (Tata Motors) and Lexus (Toyota)[21] are targeting 100% ZEVs globally by 2025 and 2030, respectively, while Hyundai and Honda aim to reach 100% ZEVs by 2040. Audi (VW) is aiming for 100% ZEVs globally except in China by 2033, while GM, Ford, Mercedes-Benz, and Land Rover (Tata Motors), as ZEV Declaration signatories, are all targeting 100% ZEVs in leading markets by 2035.

Larger global automakers, such as Stellantis, VW Group, and Toyota, currently do not have 100% global ZEV targets, and have instead announced mid-term targets for specific markets or brands. For example, Stellantis, the automaker with the largest market share in Brazil, has committed to reach 100% ZEVs for passenger cars in Europe and 50% ZEVs for light vehicles in the United States by 2030. VW aims for 80% ZEVs for passenger cars in Europe, 55% for LDVs in the North America, and 50% in China by 2030; targets differ for other VW Group brands, including Škoda (70% ZEVs globally

21 Targets for Lexus and for Audi, discussed in the next sentence, are not shown in Table 2.

by 2030) and Porsche (80% ZEVs globally by 2030). Toyota has announced a sales target of 3.5 million ZEVs by 2030—representing about 32% of projected vehicle production in 2030, according to ICCT estimates—while championing hybrids and PHEVs in most markets.[22]

China-based automakers, which have led the EV transition in Brazil, have announced global EV sales share targets of varying levels of ambition. Beyond BYD, the only all-electric China-based manufacturer considered, Geely (Volvo Cars) has set a target of 90% EV sales globally by 2030, Great Wall is targeting 80% EV sales by 2025, and Chery is aiming for 40% EV sales by 2025. Targets for all four manufacturers include both BEVs and PHEVs.

By contrast, of the 17 automakers considered in this study, none has explicitly set ZEV targets for Brazil. Volvo Cars has confirmed that its global target of 90% ZEV sales by 2030 applies to Brazil.[23] Meanwhile, the Hyundai brand has disaggregated its global target of 36% ZEV sales by 2030 by market: 100% in Europe, 33% in the United States, 12% in the Republic of Korea, and 30% in "other" markets, which may include Brazil.

Moreover, some automakers have signaled a continued emphasis on ICEVs in Brazil and other markets despite ambitious electrification targets in advanced economies. In 2024, Stellantis, the largest vehicle producer in Brazil, announced a €5.6 billion (R$ 30 billion) investment plan in South America for 2025–2030 focused on advancing bio(fuel)-hybrid technologies that integrate electrification with ethanol gasoline flex-fuel engines.[24] The announcement indicated that "in the future, the region will also produce a battery electric vehicle," but did not specify a timeline.[25] In addition, the first new Stellantis models announced in Brazil following the release of the plan were flex-fuel MHEVs with limited emissions reduction potential. The ICCT has estimated that the average MHEV sold in Brazil has higher CO_2-equivalent (CO_2e) emissions than the average of all passenger cars sold in the country, including ICEVs.[26]

Likewise, Audi, a VW Group brand**,** has stated that its market strategy in Brazil will include a mix of gasoline ICEVs and hybrids despite 100% ZEV sales targets in most leading markets.[27] This is similar to the strategy announced by the VW brand, which leads in EV sales in key markets such as Europe and North America but which remains focused on gasoline- and diesel-powered vehicle production in South Africa.[28]

These targets indicate differences in EV deployment strategies by the largest automakers in Brazil with respect to other major markets, notably the United States and Europe. Although Brazil has stated its ambition to reach net-zero emissions by 2050, it has neither defined goals specific to the transportation sector nor set phaseout targets for ICEVs. This policy gap may contribute to the lack of Brazil-specific EV targets from legacy automakers in the country. Considering the limited potential of flex-fuel hybrids to reduce CO_2 emissions, the continued absence of regulatory action

22 For the methodology underlying this estimate, see Shen et al., *Global Automaker Rating 2023*.

23 Surveys were sent to automakers to review the information we collected on ZEV commitments. For more information, see Appendix A.

24 Stellantis, "Stellantis Announces €5.6 Billion Investment in South America, Marking the Largest Investment in the Region's Automotive Industry," press release,, March 6, 2024, https://www.stellantis.com/en/news/press-releases/2024/march/stellantis-announces-5-6-billion-investment-in-south-america-marking-the-largest-investment-in-the-region-s-automotive-industry.

25 Stellantis, "Stellantis Announces."

26 Haytzmann and Cieplinski, *Tecnologias*.

27 Gilson Garrett Jr., "Não é só Elétrico: Audi Aposta em Carros Híbridos e a Combustão no Brasil [It's Not Just Electric: Audi Bets on Hybrid and Combustion Cars in Brazil]," Exame, June 10, 2024, https://exame.com/casual/nao-e-so-eletrico-audi-aposta-em-carros-hibridos-e-a-combustao-no-brasil/.

28 Antony Sguazzin, "VW, Isuzu Spurn South Africa's Efforts to Kick-Start EV Industry," *Bloomberg*, June 10, 2024, https://www.bloomberg.com/news/articles/2024-06-11/volkswagen-isuzu-pour-cold-water-on-south-africa-s-ev-ambitions.

focused on decarbonizing the national LDV fleet could result in a market dominated by outdated vehicle technologies and pose significant challenges for Brazil to comply with Paris Agreement goals.

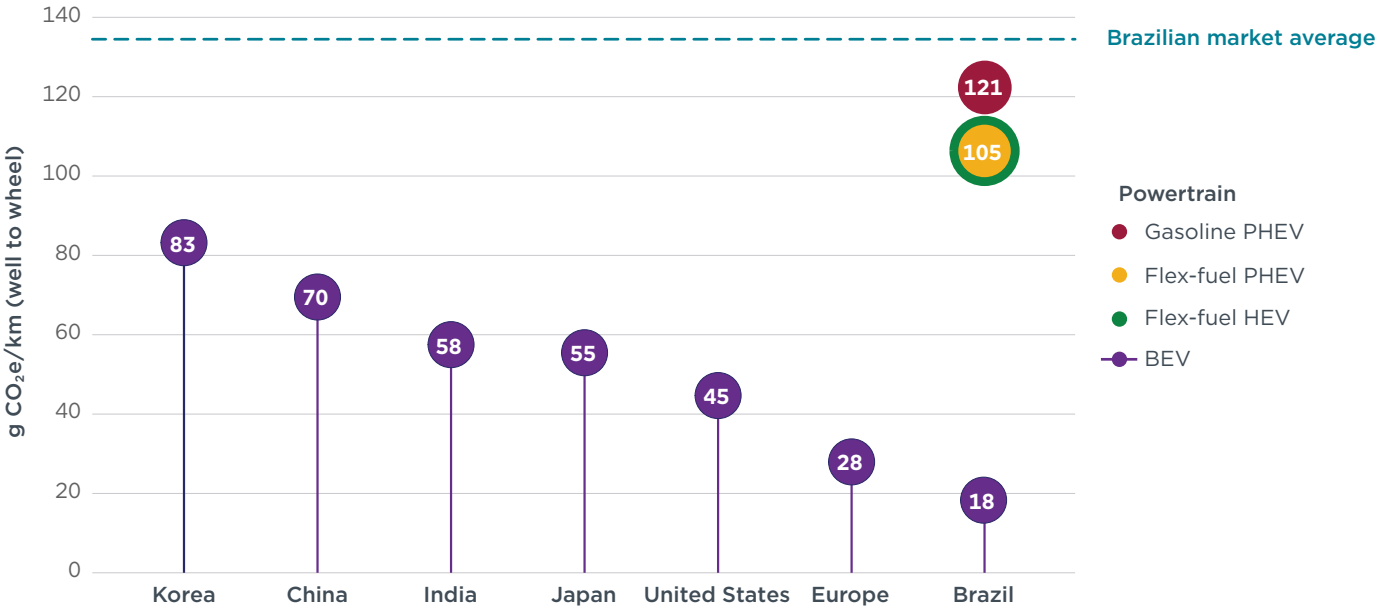
WELL-TO-WHEEL EMISSIONS: COMPARING BEVS, PHEVS, AND HEVS IN BRAZIL WITH BEVS IN OTHER MAJOR MARKETS

We next assess how, in the case of Brazil, a decarbonization strategy focused on flex-fuel hybrids would position the country to reach its net-zero ambitions relative to a strategy that prioritizes BEVs. Brazilian sugarcane ethanol has substantial potential to reduce GHG emissions compared with fossil fuels. However, the low carbon intensity of Brazil's electricity grid provides a strong advantage for the decarbonization of road transport via electrification.

Figure 4 compares the well-to-wheel CO_2e emissions of the average BEV, PHEV, and HEV passenger car in Brazil with those of the average BEV in each of the six major markets in the ICCT's *Global Automaker Rating*.[29] The emissions of flex-fuel engines were estimated using the energetic market share in 2023 of 28% hydrated ethanol (E100) and 72% gasoline C (E27). All PHEVs sold in Brazil in 2023 had gasoline-only engines, but we also estimated PHEV emissions if the same models had ethanol-gasoline flex-fuel engines, following the methodology in Appendix C. The horizontal dashed blue line indicates the sales-weighted average of well-to-wheel CO_2 emissions from all models sold in Brazil in 2023, most of which are flex-fuel ICE vehicles.

Figure 4

Comparison of well-to-wheel emissions of the average BEV, PHEV, and HEV in Brazil with the average BEV in other major markets, 2023



29 For this calculation, we used liquid fuels emission factors in CO_2e/MJ and electricity generation emission factors in CO_2/MJ. This approach results in a small bias that underestimates total GHG emissions from electricity. Based on a 100-year global warming potential, CO_2e emissions from methane (CH_4) and nitrous oxide (N_2O) corresponded to less than 2% of Brazilian grid emissions in 2021. For more information on this methodology, see Appendix B.

The results in Figure 4 highlight that BEVs in Brazil are estimated to have lower well-to-wheel CO_2 emissions than BEVs in any of the six other major markets, mostly due to the country's clean energy grid. With over 90% renewable electricity generation in 2023,[30] Brazil's electricity grid had an estimated emission intensity of 28.6 g CO_2/MJ, 48% lower than that of the European Union and 68% lower than that of the United States. On the other hand, Brazil had, on average, the least efficient BEVs among all seven markets, consuming about 0.63 MJ/km, 23% above the mean BEV in the European Union and 43% above the mean BEV in China. This is partly due to the larger average size of BEVs in Brazil, where BEV sales in 2023 were concentrated in larger segments relative to ICEV sales, despite the arrival of new automakers supplying smaller and more efficient BEVs.

While BEVs in Brazil have lower estimated well-to-wheel CO_2e emissions than those in the six other major markets, the estimated emissions of PHEVs and HEVs in Brazil are higher than BEV emissions across all the other regions considered. The estimated emissions of gasoline PHEVs in Brazil (121 g CO_2e/km) were only 10% below the average emissions of all new passenger cars, including ICEVs (134 g CO_2e/km), while those of gasoline-ethanol flex-fuel HEVs and PHEVs (105 g CO_2e/km) were 22% below the market average. The similarity in emissions between flex-fuel HEVs and PHEVs may be explained by the limited use of PHEVs in electric driving mode due to consumer behavior,[31] lack of charging infrastructure, short electric driving range, and the supply concentrated on larger vehicle segments.

Although the combination of a low-carbon grid and ethanol availability could result in PHEVs with significant decarbonization potential in Brazil, the achievement of this potential is uncertain. Even the hypothetical flex-fuel PHEV did not achieve lower emissions than BEVs in the other six markets; meanwhile, as shown in a previous ICCT study, the estimated GHG mitigation potential of HEVs is lower than that of PHEVs in Brazil.[32] While hydrated ethanol (E100) has approximately 50% lower well-to-wheel emissions than gasoline C, its limited real-world use (28% by volume among LDVs in 2023) constrains the decarbonization potential of flex-fuel vehicles in Brazil.

These estimates support the importance of EVs, and particularly BEVs, for reducing transportation emissions in Brazil.

CONCLUSION

This study identified differences between the decarbonization strategies of leading automakers in the Brazilian market and their approaches in other major markets. In the context of a lack of clear policy guidance and ZEV-enforcing regulations in Brazil, manufacturers have adopted strategies that focus on flex-fuel hybrids and continued sales of ICEVs. Neither historical trends in ethanol usage nor the combination of flex-fuel engines with hybrid powertrains demonstrate greenhouse gas mitigation potential sufficient for this strategy to align with Brazil's climate goals.[33] Without policy guidance to direct investments to ZEVs, whose life-cycle emissions in Brazil outperform all other major markets, transportation sector emissions could put the achievement of Brazil's net-zero by 2050 target at risk.

30 Ministry of Mines and Energy, "*Fontes Renováveis Responderam por 93,1% da Geração de Energia Elétrica em 2023*" [Renewable Sources Accounted for 93.1% of Electricity Generation in 2023], February 5, 2024, https://www.gov.br/mme/pt-br/assuntos/noticias/fontes-renovaveis-responderam-por-93-1-da-geracao-de-energia-eletrica-em-2023.

31 Aaron Isenstadt et al., *Real-World Usage of Plug-In Hybrid Vehicles in the United States* (International Council on Clean Transportation, 2022), https://theicct.org/publication/real-world-phev-us-dec22/.

32 The well-to-wheel emissions and emissions mitigation potential of PHEVs were assessed in Haytzmann and Cieplinski, *Tecnologias*. The emission values for PHEVs in Figure 4 of this briefing were converted to the WLTC to allow comparison with other countries and thus differ from this prior work.

33 Mera et al., *Comparison*; Haytzmann and Cieplinski, *Tecnologias*.

The 10 automakers with the largest market shares in Brazil in 2023 sold considerably fewer EVs, as a percentage of their total car sales, in Brazil than in other major markets. None of these automakers had EV sales shares above 5% in Brazil. Out of the 17 automakers analyzed in this study, only five (BYD, BMW, Geely, Tata, and Great Wall) had EV sales shares in Brazil on par with or higher than in other major markets.

The results show that many legacy automakers have not set Brazil-specific targets; others have set global targets that may apply to Brazil but are less ambitious (either in scope or deadline for implementation) than those set for other major markets. In contrast, new entrants to the national market such as BYD and Great Wall have accounted for the majority of recent EV sales in Brazil,[34] which reached a 6.5% market share in the first half of 2025, surpassing other large markets like India, Indonesia, and Mexico.[35]

The results of this study have important implications for the decarbonization of Brazil's road transportation sector. The country's third LDV energy efficiency and emissions program, MOVER, has set a target to reduce energy consumption by 12% by 2027—less ambitious than some leading markets—and provides fiscal incentives for producing flex-fuel hybrids until 2026 despite its objective to reduce vehicle emissions and help achieve Brazil's net-zero commitment by 2050. This analysis supports two policy considerations focused on positioning Brazil to meet its climate ambitions:

1. **The adoption of more restrictive corporate average emissions reduction targets (per manufacturer) in the second phase of the MOVER Program (2028–2032) could encourage automakers to develop EV-based strategies and investments aligned with Brazil's 2050 net-zero ambitions.** The target for the first phase of the program, which aims for a reduction in energy consumption of 12% between 2022 and 2027, is unlikely to promote investments in ZEVs, as it can be achieved with incremental improvements in combustion engine vehicles. The targets for the second phase of the MOVER program, which will be defined in cradle-to-grave emissions, could be designed to require more substantial reductions in GHG emissions while giving manufacturers adequate time to adjust their strategies and invest in ZEVs for the Brazilian market.
2. **A feebate system or tax mechanism could be established to support the adoption of EVs by Brazilian consumers.** The law that established MOVER also provided for the creation of a feebate system, in which fees on the sale of high-emitting vehicles would be used to finance purchase subsidies for low-emission vehicles. Additionally, Brazil's indirect tax reform of early 2025[36] also established a new "selective tax" that will increase the tax burden on goods that are harmful for the environment and health, including vehicles. Either the feebate system or the selective tax could be designed to calibrate vehicle purchase costs in line with their greenhouse gas emissions and thus guide consumers toward low-emitting vehicles. The feebate system can also be designed to be revenue-neutral for the government, with high GHG emissions vehicles compensating for the subsidies on zero and low emissions vehicles.

34 These two automakers were responsible for 86% of BEVs and 69% of the PHEVs sold in Brazil between January 2023 and April 2024; see Cieplinski, *Evolução*.

35 Ilma Fadhil and Chang Shen, *Global Electric Vehicle Market Monitor For Light-Duty Vehicles in Key Markets, 2024* (International Council on Clean Transportation, 2025), https://theicct.org/publication/global-ev-market-monitor-for-ldv-in-key-markets-2024-jun25/.

36 Complementary Law No. 214, of January 16, 2025, https://www.planalto.gov.br/ccivil_03/leis/lcp/lcp214.htm.

APPENDIX A. SCOPE OF TARGETS AND SALES

Our analysis considered automaker commitments through 2024. Information was primarily sourced from manufacturers' annual sustainability reports, supplemented with publicly available information (e.g., press releases, media articles, and announcements). We asked automakers to review the input data and information on manufacturer-specific actions and commitments used in the analysis. We incorporated additional information received from manufacturers that reflected relevant information in 2024. When automakers disagreed with our information, they generally provided revised or updated data, which were used for the analysis if we were able to verify it.

We obtained vehicle dimension information and 2023 sales data for Brazil from JATO Dynamics,[37] and type-approval energy efficiency and electric range data from the Brazilian Vehicle Labeling Program (PBEV, from *Programa Brasileiro de Etiquetagem Veicular*).[38] We then estimated the sales-weighted average CO_2 emissions of all BEVs and PHEVs sold in Brazil in 2023, comprising 56 BEV and 21 PHEV models. The energy consumption of PHEVs in combustion and electric modes differs and must be calculated separately. Since the PBEV applies a real-world correction to combustion and electric mode consumption values, we reverted these to type-approval values using the equations presented in Ordinance No. 169/2023.[39]

Model-level sales data for major markets in 2023 were sourced from MarkLines[40] (United States, Republic of Korea, and Japan), Dataforce[41] (European Union, European Free Trade Association Member States, and the United Kingdom), Segment Y[42] (India), and Gasgoo[43] (China). Data on energy consumption for BEVs in all major markets were obtained from specification brochures on manufacturers' official websites and from major EV information hubs, including EV Database,[44] EV Specifications,[45] EV Volumes,[46] Yiche,[47] and Autohome.[48]

37 Jato Dynamics, *Sales of Cars and Light Commercial Vehicles in Brazil*, 2021–2024.

38 National Institute of Metrology, Quality and Technology, *Veículos Leves 2023 – 15º Ciclo* [Light Vehicles 2023 – 15o Cycle], updated November 22, 2023, https://www.gov.br/inmetro/pt-br/assuntos/avaliacao-da-conformidade/programa-brasileiro-de-etiquetagem/tabelas-de-eficiencia-energetica/veiculos-automotivos-pbe-veicular/pbe-veicular-2023.pdf/view.

39 Ordinance No. 169, of May 3, 2023, https://www.in.gov.br/en/web/dou/-/portaria-n-169-de-3-de-maio-de-2023-485619287.

40 MarkLines, https://www.marklines.com/.

41 Dataforce, *Automotive Market Data & PCV Registrations*, https://www.dataforce.de/en/.

42 Segment Y, *Vehicle Volumes System*, https://www.segmenty.com/index.html.

43 Gasgoo, *Gasgoo Data Portal*, https://i.gasgoo.com/.

44 EV Database, *Electric Vehicle Database*, https://ev-database.org.

45 EV Specifications, *Electric Vehicle Specifications, News, and Comparison*, https://evspecifications.com.

46 EV Volumes, *EV Data Center*, https://www.ev-volumes.com/.

47 Yiche, https://yiche.com.

48 Autohome, https://autohome.com.

APPENDIX B. VEHICLE CLASS DEFINITION

To allow for comparison across markets, we categorized LDVs in Brazil and the six major markets into eight classes, presented in Table B1. PC classifications are based on vehicle length, while LCV classifications are based on vehicle curb weight. BEVs typically weigh more than ICEVs due to their batteries; as EU curb weight classifications were originally designed for ICEVs, directly mapping BEVs into these weight classes can result in misclassification. To address this, battery electric LCV curb weights were multiplied by a factor of 0.83, consistent with the *Global Automaker Rating 2023*.[49]

Table B1
Definition of LDV classes

Fleet	Class standards	Length (m)	Source
PC	Mini/subcompact	0 – 4.1	Adapted from EV Volumes classifications
	Compact	4.1 – 4.6	
	Midsize	4.6 – 4.8	
	Large	4.8 –	
	SUV/MPV	N/A	
Fleet	**Class standards**	**Reference mass[50] (kg)**	**Source**
LCV	Small	0 – 1,305	EU N1 subclasses
	Medium	1,305 – 1,760	
	Large	1,760 – 3,500	

49 Shen et al., *Global Automaker Rating 2023*.

50 The reference mass is the unladen vehicle mass plus 100 kg.

APPENDIX C. WELL-TO-WHEEL EMISSIONS METHODOLOGY

We compared average well-to-wheel CO_2e emissions of BEVs in China, Europe, the United States, Japan, India, and the Republic of Korea with BEVs, PHEVs, and HEVs in Brazil. Well-to-wheel CO_2e emissions include all GHG emissions generated during resource extraction, production, distribution, and energy use through combustion in the case of liquid fuels, and their global warming potential is expressed in terms of CO_2.

We calculated average well-to-wheel CO_2e emissions for BEVs based on their sales-weighted average type-approval energy consumption (MJ/km) and the emission factor of electricity (g CO_2e/MJ) in each country. The emissions of non-plug-in hybrids and ICEVs were calculated in the same way, but using the emission factor of fuel instead of electricity. PHEVs require a more complex approach, as they operate with both an electric motor and a combustion engine. Estimating their emissions involves accounting for the type-approval values of both combustion and electric engines, the utility factor of the electric mode (which is a function of the electric motor range), and the emission factors of both electricity and liquid fuel.

All PHEVs sold in Brazil in 2023 had gasoline-only engines. In this study, we also estimated PHEV emissions if the same models had ethanol-gasoline flex-fuel engines. To do so, we maintained the same average type-approval values for the combustion engines, in MJ/km, and the same electric-mode utility factor but included an additional factor to calculate the emissions of flex-fuel combustion engines: namely, the proportion that drivers choose ethanol (E100) over gasoline C (E27). In 2023, the energetic market share of ethanol was 28% of the total energy of ethanol and gasoline C consumed in flex-fuel vehicles throughout the year.[51]

The type-approval values of Brazilian vehicles, which are provided by PBEV, are measured in the U.S. 2-cycle.[52] To compare emissions from different countries, all energy consumption values were converted to the WLTP cycle. For EVs, this conversion consists of multiplying the type-approval energy consumption by a factor of 1.2.[53] Combustion engines' type-approval fuel consumption values were converted using the conversion tool available on the ICCT's website.[54]

We used well-to-wheel emission factors for gasoline C and hydrated ethanol from a previous ICCT study[55] and electric grid emission factors from the International Energy Administration's Stated Policies Scenario.[56] These values are presented in Table C1.

51 Energy Research Office, *Nota Técnica.*

52 The Brazilian norms for urban (ABNT NBR 6601) and highway (ABNT NBR 7024) conditions use the same test procedure as the U.S. Environmental Protection Agency Federal Test Procedure (FTP-75). Under the Brazilian labeling program, the tested fuel consumption in the urban and highway drive cycles are increased by factors of 18% and 35%, respectively, as well as by a constant term. The corrected values are then weighted by a share of 55% urban and 45% highway driving.

53 Eric Loveday, "How To Convert Conflicting EV Range Test Cycles: EPA, WLTP, CLTC," *InsideEVs*, updated January 13, 2025, https://insideevs.com/features/343231/heres-how-to-calculate-conflicting-ev-range-test-cycles-epa-wltp-nedc/.

54 Jörg Kühlwein, John German, and Anup Bandivadekar, *Development of Test-Cycle Conversion Factors Among Worldwide Light-Duty Vehicles CO_2 Emission Standards* (International Council on Clean Transportation, 2014), https://theicct.org/publication/development-of-test-cycle-conversion-factors-among-worldwide-light-duty-vehicle-co2-emission-standards/.

55 Mera et al., *Comparison*.

56 International Energy Agency, *World Energy Outlook* 2023 (2023), https://www.iea.org/reports/world-energy-outlook-2023.

Table C1

Fuels' well-to-wheel CO_2 emission factors for Brazil and electricity's well-to-wheel carbon intensities in Brazil and other major markets

Fuel emission factor in Brazil	
Fuel type	**Emission factor (g CO_2e/MJ)**
Gasoline C (E27)	81.8
Hydrated ethanol (E100)	39.4
Electricity production	
Country or region	**Emission factor (g CO_2/MJ)**
Brazil	29.0
China	159.2
European Union	54.7
India	186.6
Japan	108.8
Republic of Korea	154.6
United States	89.3

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