Value Chain Analysis of Electric Bus Production in Germany and Brazil

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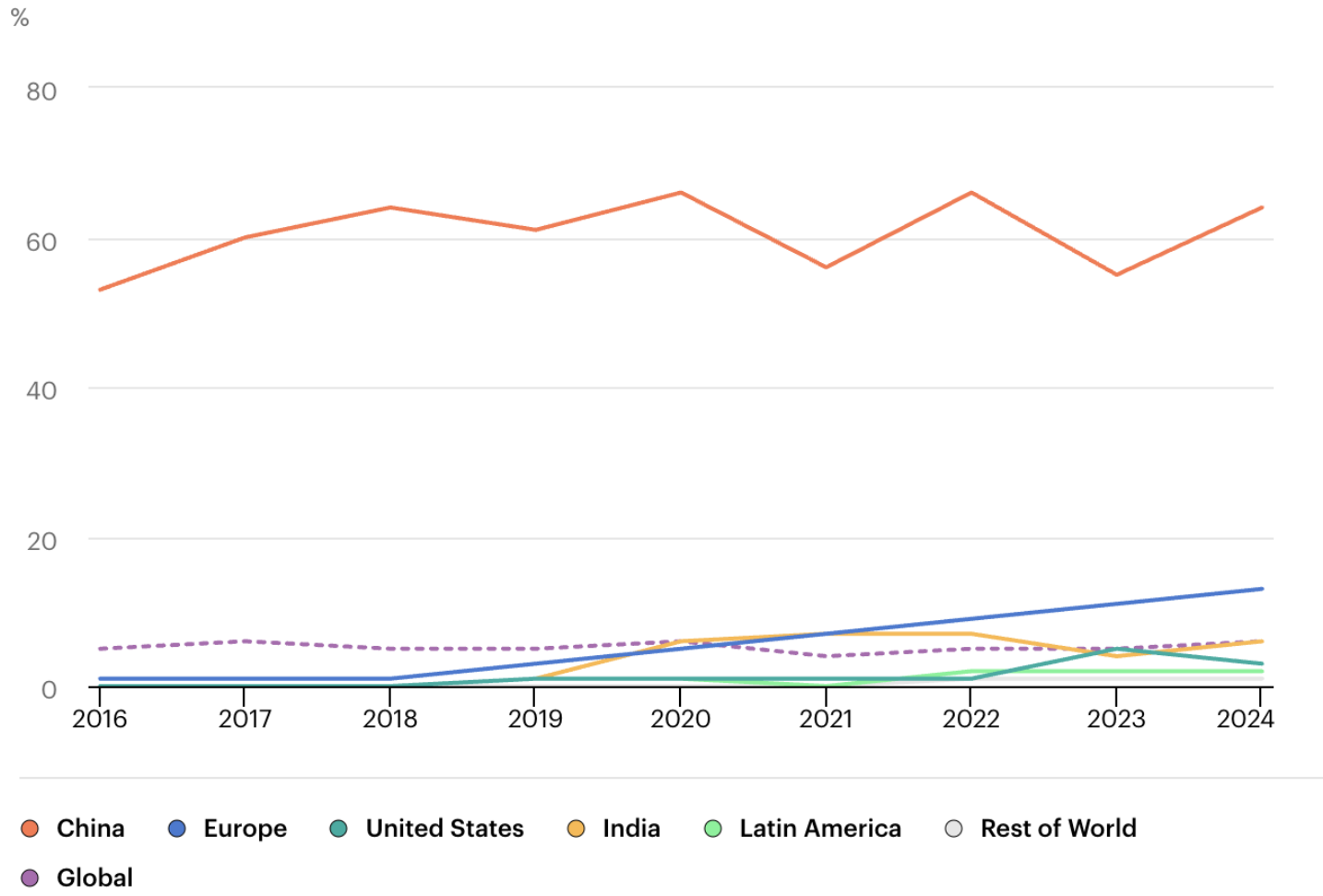
Comparative summary of electric traction bus types

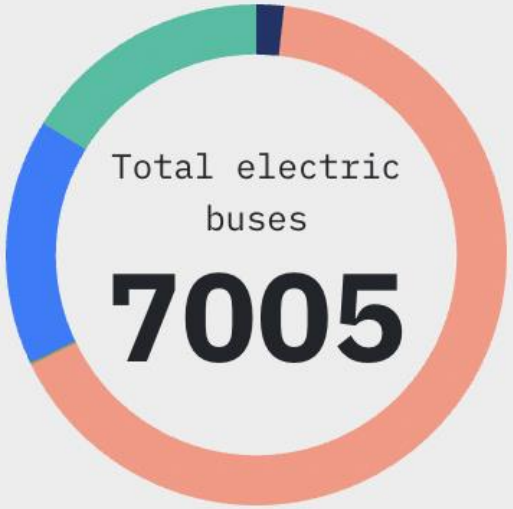
Bus Typology	Main Energy Source	Typical Range (km)	Main Advantages	Main Disadvantages	Main current Applications (Brazil)	Main current Applications (Germany)
Trolleybus	Continuous grid connection via overhead catenary	Unlimited (grid-dependent)	Zero local emissions, mature technology, stable operations, low battery needs	High infrastructure cost, visual impact, dependence on fixed catenary grid	São Paulo (201 vehicles in operation)	Solingen, Eberswalde, Esslingen (long-standing fleets)
Hybrid Bus (Conventional & Plug-in)	Internal combustion + electric motor (parallel or series)	200–350	Flexibility with dual energy sources, lower emissions than diesel, fuel savings with biofuels	Higher CAPEX and OPEX, complex integration, limited zero-emission operation	São Paulo (Scania ethanol-hybrid), Curitiba (pilots)	Berlin (BVG Volvo hybrids), Hamburg (Mercedes Citaro)
Battery Electric Bus (BEB)	Onboard battery (plug-in, pantograph, inductive charging)	150–350 (depending on battery size and charging system)	Zero tailpipe emissions, high energy efficiency, compatibility with renewable electricity	High battery cost, charging infrastructure required, battery degradation, grid impact	São Paulo (BYD fleet), Campinas, Salvador	Berlin (BVG fleet expansion), Hamburg (VHH), Cologne

Electric bus sales share by region, 2016-2024 (IEA, 2025)



E-Buses in Latin America

by vehicle type | by manufacturer

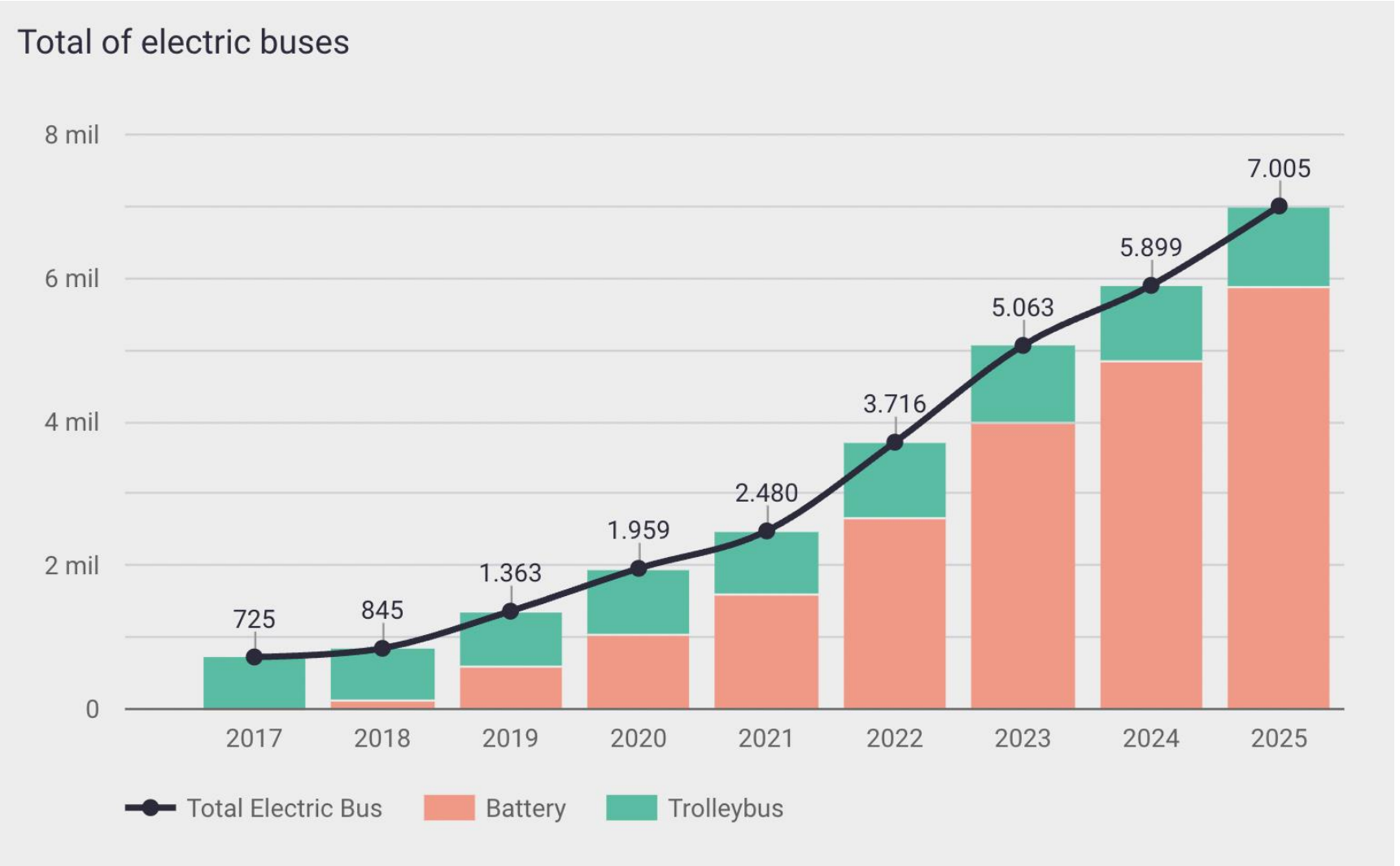


- Articulated e-bus (>18 meters)
- Standard e-bus (12-15 meters)
- Double-decker
- Midi e-bus (8-11m)
- Trolleybus

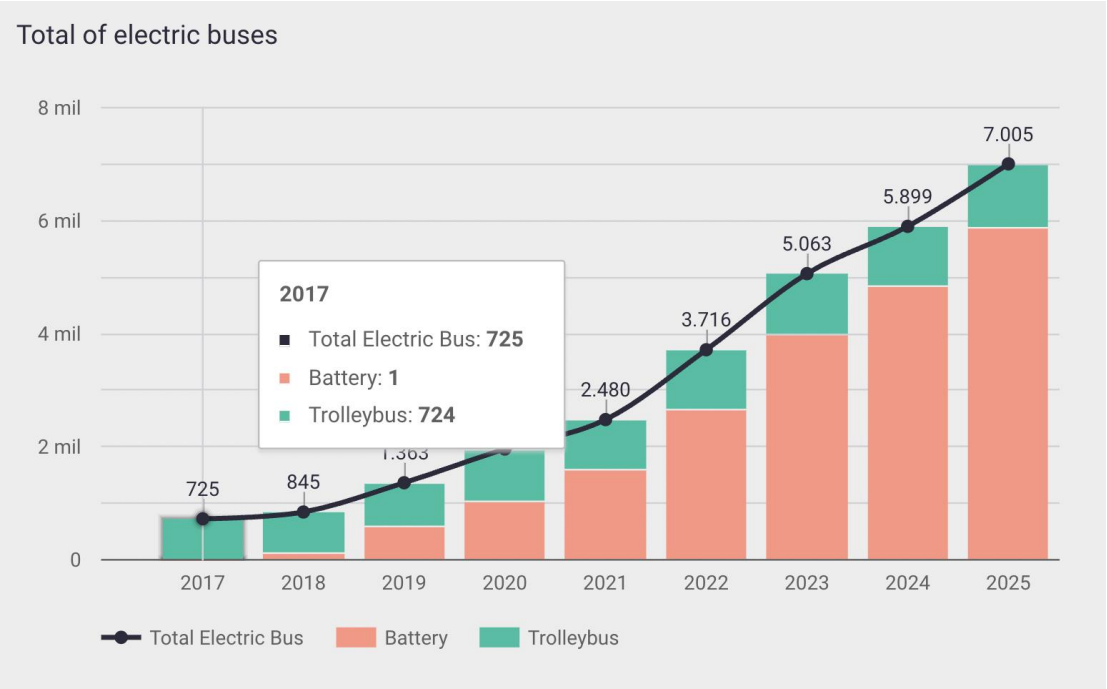
7456.59 kt

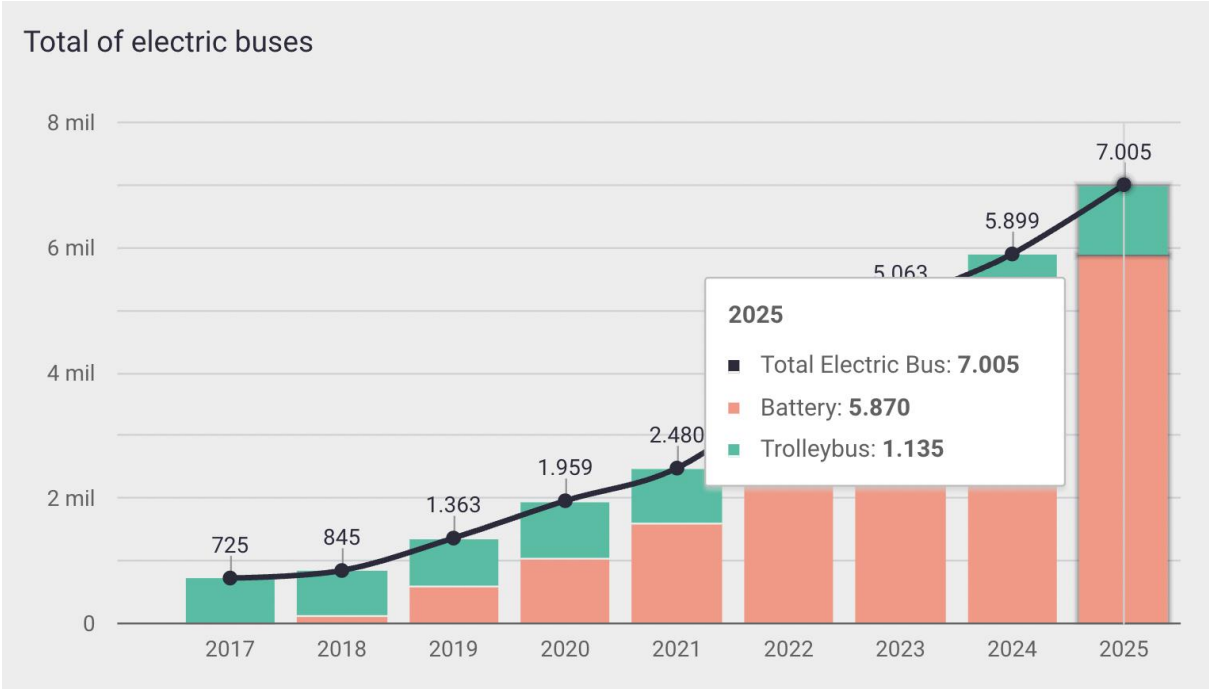
Emissions avoided by fleet (kt CO_2e)

E-Buses in Latin America



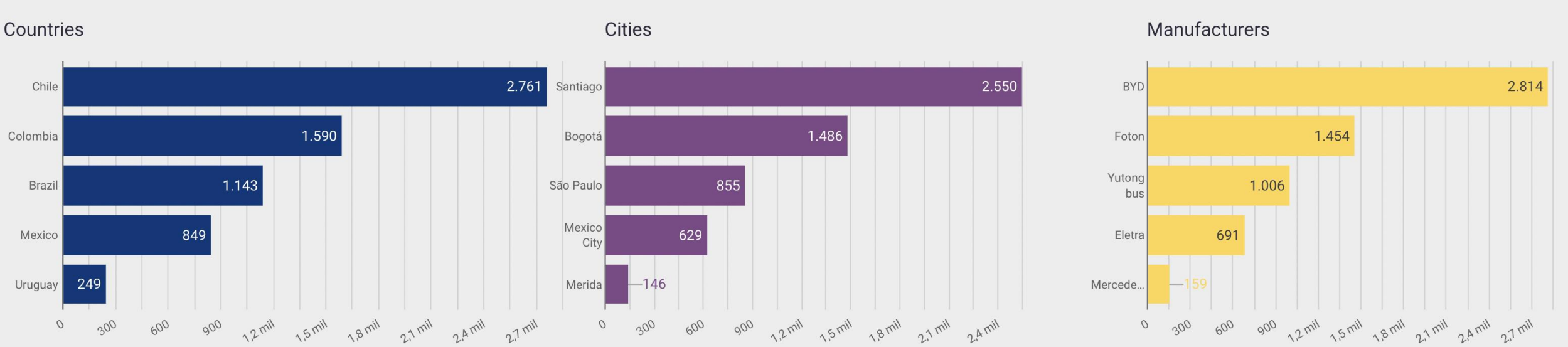
E-Buses in Latin America





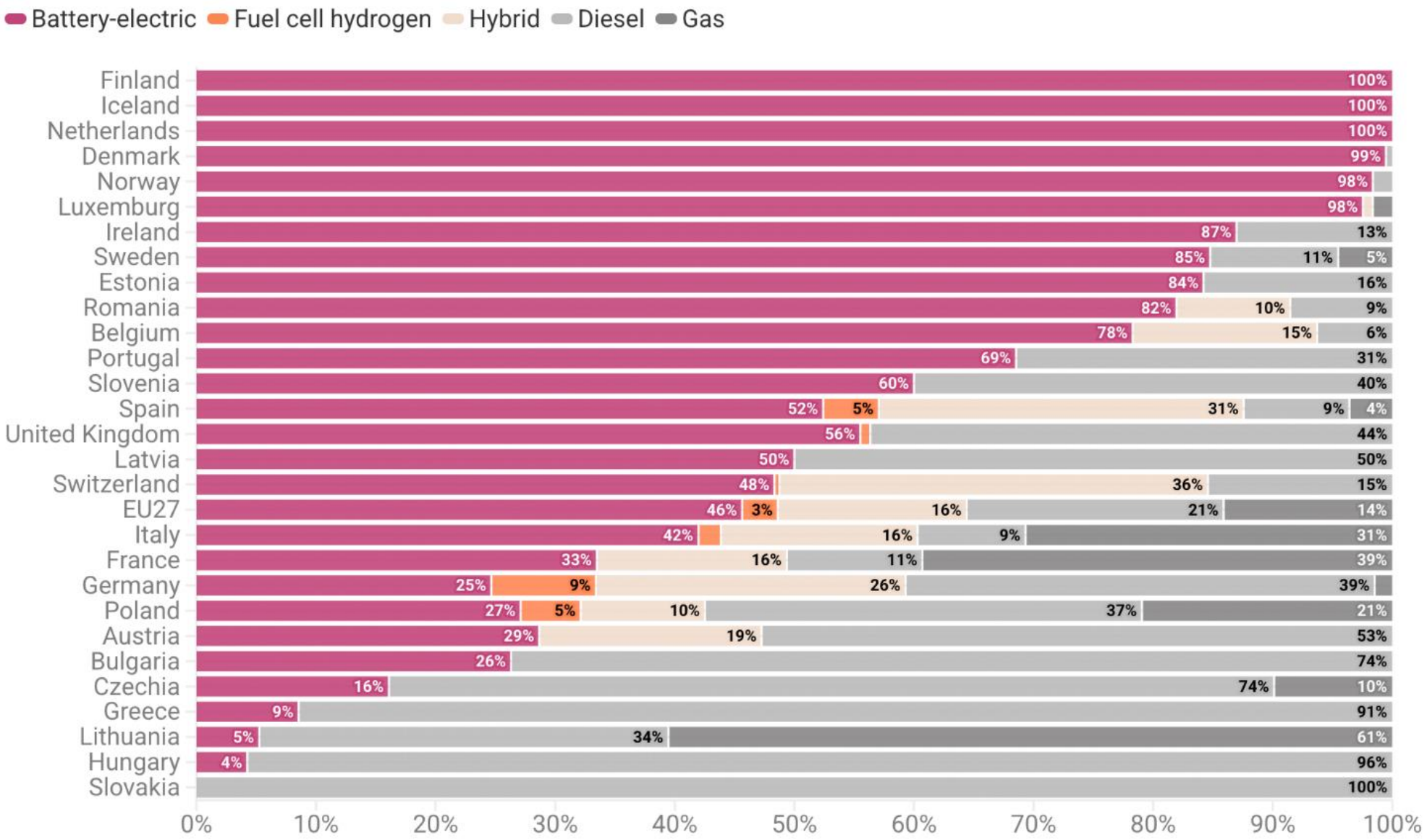
The number of trolleybuses almost doubled, while the number of BEBs increased from 1 to 1,135.

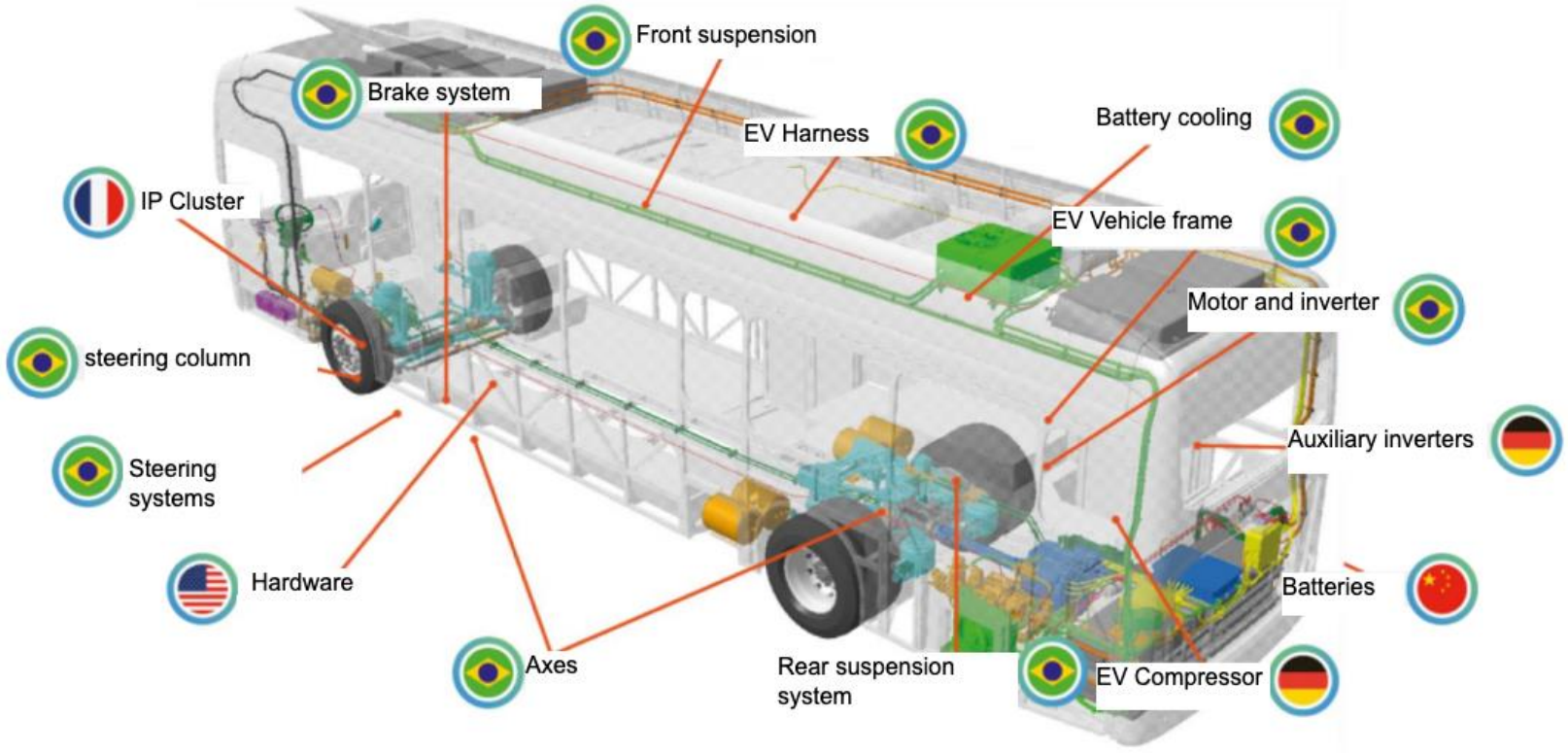
E-Buses in Latin America



Company	Factory in Brazil	Specialization	Products
Mercedes-Benz	São Bernardo do Campo (SP)	Trucks, bus chassis, cabins and aggregates such as engines, gearboxes, and axles	Standard chassis (e0500U)
Volkswagen Buses and Trucks	Resende (RJ)	Trucks and buses	Standard chassis (e-Volksbus)
Volvo	Curitiba (PR)	Trucks, buses, construction equipment, marine and industrial engines	Standard chassis (Volvo BZL)
BYD	Campinas (SP) Manaus (AM)	Energy storage and electric vehicles	Standard and articulated chassis (D9W; D9A; D9F; D11A; D11B). Lithium iron phosphate battery modules (LiFePO4)
Eletra	São Bernardo do Campo (SP)	Electrification, electric buses, trolleybuses, hybrids and diesel-to-electric bus conversions	Electric e-bus (Midi, standard and articulated). Dual hybrid bus (standard and articulated). Trolleybuses (standard)
Marcopolo	Caxias do Sul (RS) São Mateus (ES)	Bus bodyworks	Standard and articulated electric chassis bodyworks (Attivi Express). Standard electric bus (Attivi)
Higer (Project canceled)	Pecém (CE)	Buses and vans	Standard and articulated electric buses (Azure A12BR, Azure A13BR and A18BR)

New city bus sales in Europe in 2024 (T&E, 2025)





Marcopolo Attivi Integral origin of components
São Paulo (2024)

BEB Value Chain

Supply of raw materials and critical components

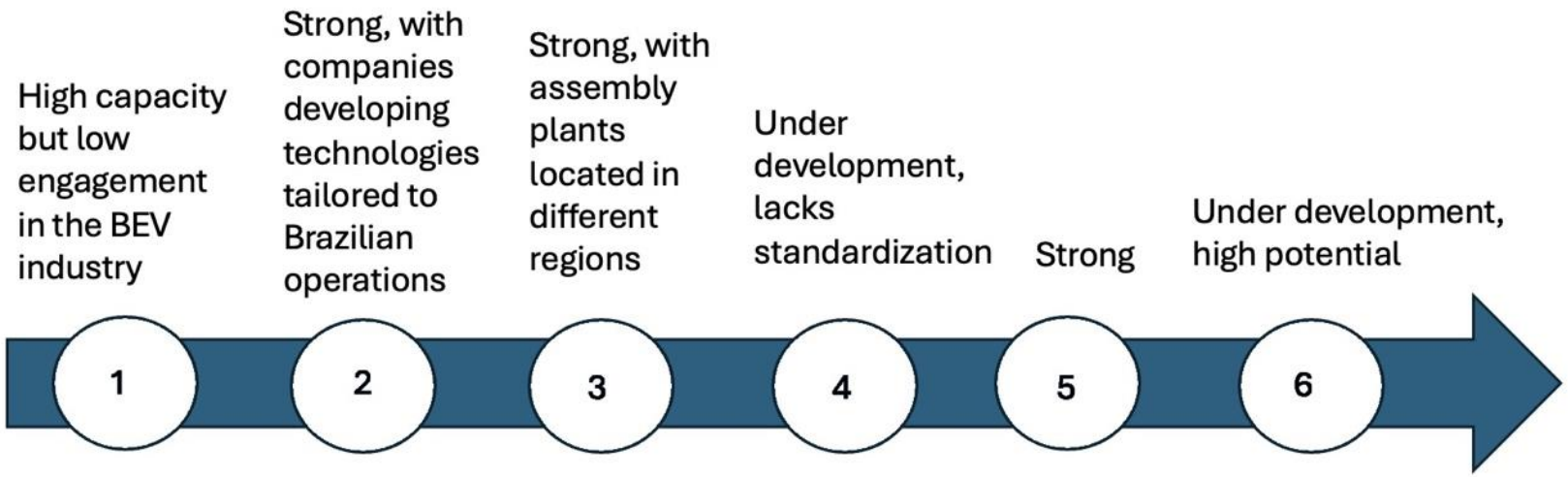
Supply of onboard technology

Battery assembly and vehicle integration

Charging and energy infrastructure

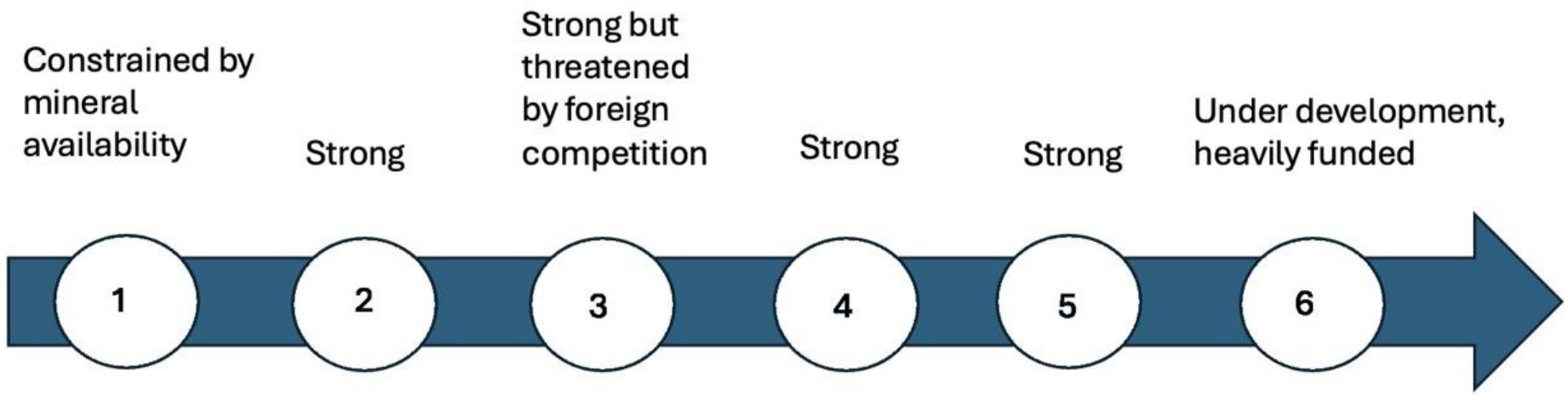
Fleet operation and maintenance

Reverse logistics and recycling



Assessment of the BEB Value Chain in Brazil

1. Supply of raw materials and critical components
2. Supply of onboard technology
3. Battery assembly and vehicle integration
4. Charging and energy infrastructure
5. Fleet operation and maintenance
6. Reverse logistics and recycling



Assessment of the BEB Value Chain in Germany

1. Supply of raw materials and critical components
2. Supply of onboard technology
3. Battery assembly and vehicle integration
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5. Fleet operation and maintenance
6. Reverse logistics and recycling

Germany

Germany’s BEB industry builds on a well-established automotive base, advanced industrial capabilities, and a clearly articulated policy framework, positioning the country to compete in high value-added and technology-intensive segments. Germany’s strategies, however, are constrained by structural dependence on imported raw materials and critical components, creating vulnerabilities in upstream value chain links.

Brazil

Brazil benefits from abundant mineral resources and a robust bus manufacturing base, particularly in vehicle assembly; yet it remains heavily dependent on foreign suppliers for core technological components. Furthermore, Brazil’s fragmented governance and lack of national standardization limit the scalability of its charging and energy infrastructure.

German Policy Implications

Coordinated industrial policy that links EU trade measures with Germany’s upstream investment strategies.

In this sense, securing stockpiles and a continuous flow of critical materials for electric bus manufacturing, especially for sensitive components such as batteries, is essential

Brazil Policy Implications

Strengthening Brazil's BEV competitiveness will require targeted policies to develop local component manufacturing capabilities, promote R&D in battery technology and power electronics, and integrate value-added processing of critical minerals into the domestic supply chain.

At the regional level, Brazil could lead efforts to harmonize charging technical standards and procurement policies for electric buses across Latin America.

Thanks

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